PRODUCTS finishing

FRED W. VOGEL, Editor

Volume 5 DECEMBER, 1940 Number 3

Published monthly by
Gardner Publications, Inc.
431 Main St.
Cincinnati, Ohio

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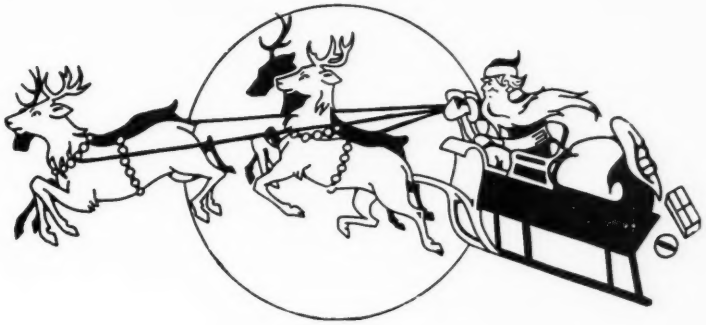

THE Season of Gifts and Greetings approaches and accordingly we take this opportunity to express our appreciation for the cooperation of the manufacturers who have throughout the past year lent us their support by means of their advertising and for the cooperation of those of our readers who have referred to this publication when sending inquiries to advertisers.

The entire staff of PRODUCTS FINISHING joins together in wishing that your Christmas may be the merriest and your New Year the happiest of any you have ever seen.

DECEMBER, 1940 Vol. 5, No. 3

COLOR FINISHES FO

The importance of color f ishes marketing of electrical equi ment

By T. CONNO
Philadelphia Works Laborato General

"AFTER Forty Years of Darkness" might be a better title for this article, since only the last four of these years have brought an increasing desire among users for colored finishes on their switchgear equipment. Today, we find a definite trend away from the traditional, earmarking dull black finish.

Previous to this recent eagerness for change, only black was used on the panel front, as shown in Figure 1. Variations using flat and gloss finishes were tried but the panel remained black. The somewhat limited use of soapstone, marbleized slate, and polished marble in the early days of switchgear are the only exceptions.

It is very probable that the endless variety of colors found on automobiles stimulated color consciousness

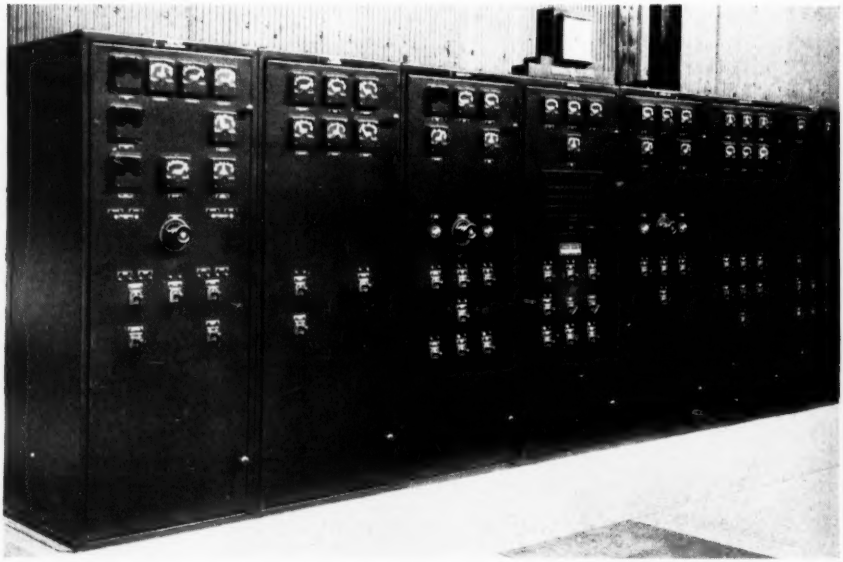

Fig. 1—Illustration showing a Duplex control board with dull black finish. Compare this with a similar piece of equipment shown in Fig. 2.

HE FOR SWITCHGEAR

lor f ishes in the manufacture and equi ment is discussed herewith.

By T. CONNOR
Laborato General Electric Company

with some utility engineers; with others, problems arose which made black finishes objectionable and in some cases impossible. Solutions to some of the problems were found in lighter finishes and colors.

Recently, one of the great electric utility companies in the West installed some massive metal-enclosed switchgear, containing operating aisles, finished in dull black. Before the job was far under way, the construction men were working in comparative darkness. The walls of dull black steel around them absorbed practically every bit of light that could be applied. Even searchlights were used but to little avail.

A light semi-gloss cream finish brought a transformation, made lighting simple, and created a cheerful and stimulating atmosphere.

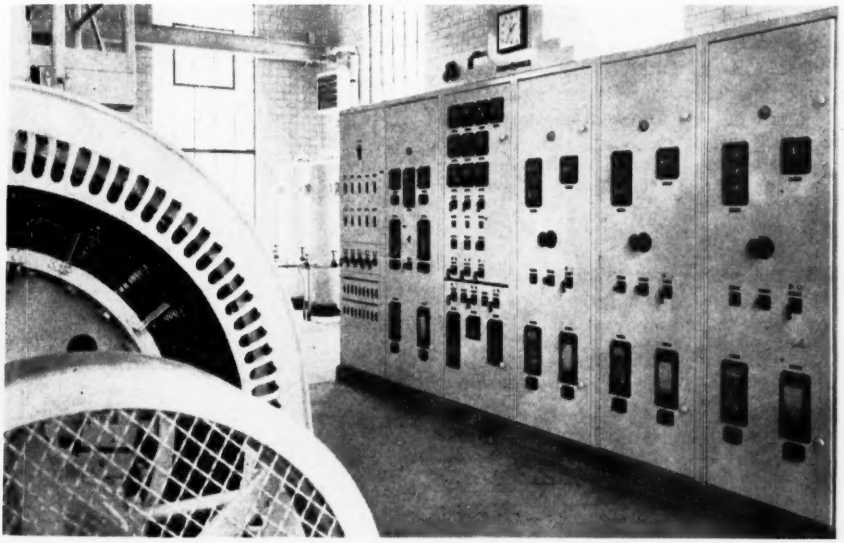

Fig. 2—The switchgear unit shown in this illustration has been attractively finished with light colored finishing material. Note particularly the manner in which the finish on this equipment brightens the surrounding area.

Choice of Finish

Switchgear demands a modest and conservative color. Bright, strong colors are usually reserved for such parts as indicators and mimic bus. In this way, the bright colors which cover only small areas, provide effective and desirable trim.

A good example of a modest switchgear finish, which is dignified yet colorful, is the bronze metallic lacquer type, especially light bronze. Warm in makeup, this type of finish creates a pleasing and cheerful atmosphere in the power station. Comparing apparatus finished in black as shown in Fig. 1, with switchgear finished in light bronze as shown in Fig. 2, convinces one of these facts.

Harmony and Pleasing Contrast

As a rule, on the interiors of buildings or rooms housing switchgear, we find a predominance of ivory, cream, or buff. With these, the most suitable, harmonious, and moderately contrasting colors for switchgear equipment are light brown shades, tans, and light bronze. Greens, although they permit harmonious contrast, find limited use.

For analogous harmony, lighter to darker tints of creams and buffs are used. Light pearl gray is particularly outstanding as a switchgear finish. These finishes are chosen when good illumination is important.

Sharp contrast is not usually desired and is definitely not recommended by lighting engineers except on comparatively small areas. For example, meters, relays, and other instruments in dull black are quite acceptable from this standpoint. In addition, the dull black here provides relief and trim. As previously mentioned, the same points apply to colors of high chromatic intensity.

Psychology and Color

Almost everyone has at least at one time felt disappointed when his choice of color failed to please the one for whom it was intended. The particular color, however, might have been one that was pleasing to many others.

Psychologists say that a strong preference or a dislike as in the above case may be a "conditioned response." The "conditioned response," they explain, could be the result of unconsciously associating a color with a long forgotten experience. If the experience were particularly good and favorable, that color is our first choice; on the other hand, if the event were an unhappy one, we might dislike the color.

Very often, value and importance are associated with color or color combinations and the finish is chosen accordingly. Keeping these thoughts in mind, we might be a lot more sympathetic with a person in his choice of color when it departs from the popular selections.

Color and Its Effects Upon Operators

A warm cheerful finish on switchgear helps to fix a good mood in the operator just as music sets the mood for the players and audience in the theater. Dark, flat, and lifeless finishes might easily cause a corresponding reaction with the operator. To say the least, this is a condition to be avoided in one entrusted with the controls of switchgear.

For the same reasons, lighting takes its place of importance in the control room. Lighting will be discussed in succeeding paragraphs.

Degree of Gloss

A reasonable amount of gloss has been found desirable and quite per-

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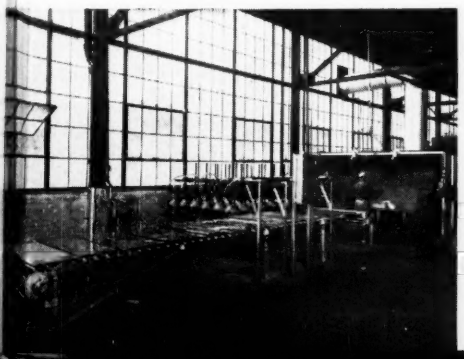
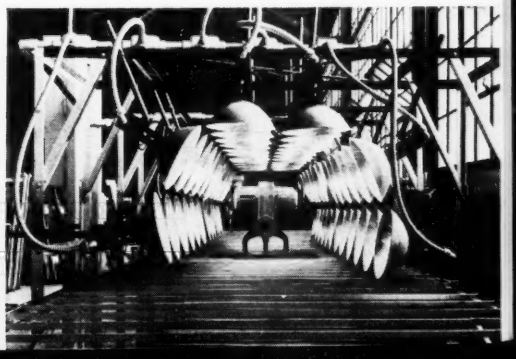


COMPLETE *Fluid Heat oil burner units, finished with Ault & Wiborg's extra-durable Polymerin are baked under infra-red lamps at Anchor. Leading finishers use Polymerin!*



missible in the switchgear finish. This is particularly true with the lighter finishes. The "mirror" qualities of finishes, of a given gloss intensity, increase as the light reflection factor decreases. Thus, high gloss white gives little glare and makes a poor mirror. High gloss black on the other hand gives a lot of glare and makes a good mirror.

The consumers' desire for some gloss in the "front of panel" finish should be expected. Those who have tried to keep a dull panel finish dull and at the same time clean and neat, know of the difficulties.

A semi-gloss finish can be more easily cleaned and will remain clean much longer than a dull finish. Smudging from handling is reduced and unnoticed on the semi-gloss coatings when light reflections from the gloss and dull finishes are equal.

Tough, mar-resistant, semi-gloss lacquers withstand many times the rubbing a dull finish will take. Neither do they show the glossy streaks that are so characteristic of the dull finish after a short time in service.

Glare and Lighting

Modern lighting arrangements, wisely chosen, can do a great deal to eliminate the annoying glare that causes eye fatigue. Good light and a high overall reflection factor of the apparatus and of the interior of the building minimizes the glare problem.

To emphasize this point we might compare the effect of glaring headlights on a dark night with that from the same headlights in full daylight. Likewise, the glare from a glossy light finish on a large area goes unnoticed while the glare from a dark or black finish of equal area and gloss can be extremely annoying.

These effects can be easily understood when we study some functions of the eye. The iris of the eye contracts when we view a well illuminated surface with a high reflection factor. Glare from such surfaces or objects on the surface does little toward further contraction of the iris, and therefore, it does not interfere with vision on large areas. Dark surfaces, on the other hand, cause the iris to dilate and remain so; however, if glare from a dark surface strikes the eye, the iris immediately contracts and as a result vision becomes poor.

Such considerations as these are becoming increasingly important factors in the purchase of switchgear, as well as other electrical equipment. Today, when the electrical manufacturer obtains an order, you can be pretty sure that the matter of finish has a part in the discussion before the purchaser places his name on the dotted line.

"A Half of a Millennium of Porcelain Enameling" is the title of an interesting booklet published by Ferro Enamel Corporation, 4150 E. 56th St., Cleveland, Ohio. The booklet traces the development of raw materials used in the manufacture of cover-coat porcelain enamels. It was prepared by the Laboratory Staff of the Ferro Enamel Corporation. Copy free upon request.

American Data Sheet No. 241. An automatic air filter unit now being manufactured by American Air Filter Co., Inc., 696 Central Ave., Louisville, Ky., is described in a bulletin designated as Data Sheet No. 241. The casing of the unit has been designed in such a way that either armored screen panels or die-stamped louver panels can be used for the filter curtain. Copy of bulletin free upon request.

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MODERN GOLD PL

The Author Discusses Structure and Color Controlling Deposits, and Chem

By Joseph B. Kushner, Ch.E.

Metal Finishing Consultant

THE most common complaint of the manufacturer of electro-gilded novelties is usually about the color of the gold deposits. If you ask him, he tells you: "That plater of mine! He plates such beautiful gold colors—only they don't match!"

"I can give him workpieces to plate in the morning and the color is fine, nice and yellow. I can give him another lot of the same work pieces in the afternoon and he plates it a nice color too, but it doesn't look like the first lot. That plater is giving me gray hair!"

But don't blame the plater all the time, Mr. Manufacturer, if gold colors aren't just right or can't be properly matched. Sometimes it isn't his fault and indeed in most cases when he does succeed in producing passable color matches he has done it by a combination of manipulation and skill that is practically tantamount to genius.

The question of color in gold plating is one that is extremely complicated. In alloy gold plating where the potentials of two or more metals must be considered, practical control of the color of the deposit is definitely out of the question; scientific control is the only thing that succeeds in delivering the goods. In pure gold plating, where only one metal has to be taken care of, practical control may meet with a modicum of success in giving uniform colors, but if relied upon entirely by the plater, he will find his way hard and stormy, as the subsequent analysis indicates. The point I wish to make is that scientific control of the gold plating bath is the only positive way to obtain consistent results.

In pure gold plating, as well as in alloy gold plating, there are certain physiological and psychological facts which place the plater behind the eight ball as far as color matching is concerned, right from the start. These facts have to do with the color sensitivity of the human eye.

Color Sensitivity of the Human Eye

Take two silver plated finishes plated at slightly different current densities and the probability is that they look closely alike in color; at least the difference between them will be so small as to escape notice

OLIPLATING - PART 4

re arColor of Pure Gold Deposits, Factors
s, arChemical Factors

on casual observation. Take two gold plated finishes deposited at the same relative difference in current density and you get a variation in color that entitles even the office stenographer the right to reprimand the plater.

The reason for this is due to the fact that the human eye is more sensitive to yellow than any other color. In other words, it sees yellow better. Examine the visibility curve of the human eye shown in the diagram Fig. 10. Note the peak in the yellow-green region of the spectrum (.54 to .57 microns) and the sharp cut-offs in the blue, violet and red regions. In the narrow band between .54 and .57 microns the eye readily distinguishes small variations in color, outside of it, the eye is relatively insensitive. Silver, which reflects all colors of the spectrum pretty uniformly, including those in

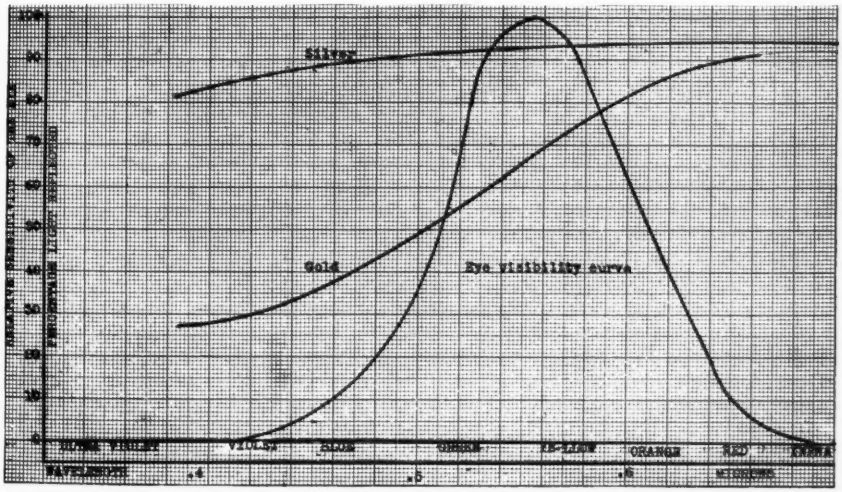

Fig. 10—Diagram illustrating the visibility curve.

the narrow band between .5 and .6 microns, looks white, and the eye finds it difficult to distinguish slight differences in the color of the two silver deposits because much more light is reflected from the other wave bands which the eye cannot so

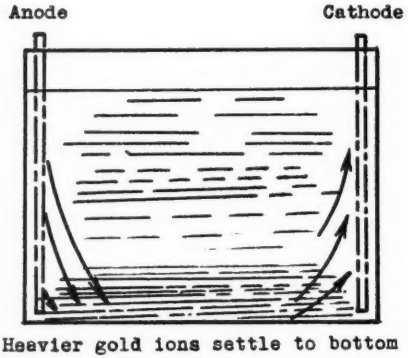

Fig. 11—Drawing illustrating the stratification found in gold plating solutions and also the path of metal particles from anode to cathode.

readily differentiate than from the narrow region of maximum eye sensitivity. On the other hand, gold reflecting white light cuts off most of the violet and the blue and reflects the greatest amount of spectral energy from the wave bands to which the eye is most sensitive. That is why shades of gold can be readily distinguished by even the most unpracticed eye.

Sometimes, however, if a gold plater wishes to get away with a little mediocre color matching, a trick of the trade (I used to work it so I know!) if two lots are to go to two different customers, is to show the supposedly matching gold plated objects to the boss under an ordinary mazda bulb. Tungsten filament bulbs give off light strong in the yellow region of the spectrum and for this reason even the palest colors of gold look rich and yellow; furthermore the edge on the eye sensitivity is taken off because there are not many other wavebands present to help the eye distinguish small variations in hue. Of course, if the boss doesn't ship the two lots off the same night and happens to look at them in the cold light of morning (gold deposits should always be inspected by daylight or lamps simulating daylight) there may be the devil to pay!

We will now consider the physical and chemical factors which control the structure, and so indirectly, the color of gold deposits.

Factors Controlling Structure and Color of Gold Deposits

Physical Factors

1. Current density (voltage a related factor).
2. Agitation.
3. Temperature.
4. Racking.
5. Basis metal.

Chemical Factors

6. Gold content.
7. Free cyanide.
8. Carbonates and other salts.
9. Addition agents.
10. pH.
11. Contamination.

Most of the factors enumerated above affect in one way or another cathode polarization. What is cathode polarization? Simply this: if a depositing metal is prevented from reaching the cathode because of a film of gas, liquid or solid, or because the metal is depleted in the immediate area of the cathode, the cathode is said to be polarized. The amount and type of cathode polarization powerfully influences the structure of the depositing metal and so controls its color. Let us see why

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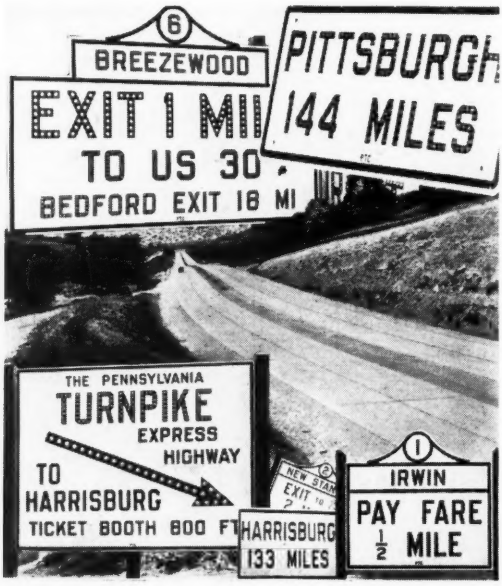
Current Density

The permissible current density in a simple gold plating bath ordinarily runs from 1-5 amperes per square foot. If we take our gold bath and start depositing gold on a test piece at the low end of the current range, the color appears pale yellow. As we increase the current density, the yellow color becomes more intense and slightly brighter until we reach a point of maximum yellowness. With further increase in the current density the test piece takes on an almost pink (rose) color then darkens down, becoming burnt or "foxy" in appearance. Further current increases result in the deposition of non-adherent gold in brown powdery form.

As the current density varies there is a change in the physical and chemical structure of the deposit and this change is reflected by the variation in color. Researchers have shown that the crystal structures of almost all electrodeposited metals go through a regular transition in form as current density is increased from zero to the burning point. First, the crystal structure is of the columnar or fibrous type, merging gradually with conical and twinned forms, then, as the curent density arrives at and goes beyond the limiting value, the structure changes to broken, arboreal (treed) or powdery. These structure changes cause the change in color.

If we were micro human beings and got ourselves a grandstand seat in the layer of gold plating electrolyte contiguous with the cathode (test piece) here is what we might be able to see when the plater turned on the current: The gold crystals at the beginning would be quite small and possess their natural greenish yellow color. As the plater increased



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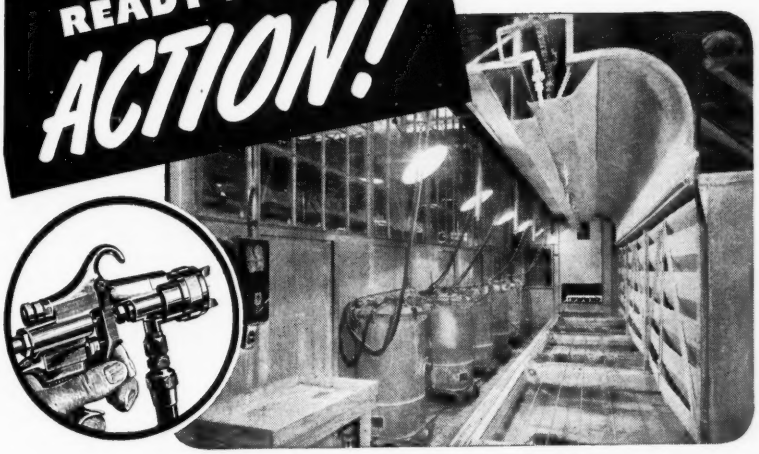

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the current the crystals would become finer in size. Since the finer sized crystals would have more total surface area, over which to absorb the violet and blue components of white light (see diagram Fig. 10) and reflect the yellow and orange, the yellow gold color would become more intense. If the plater increased the current further, hydrogen gas would start forming and the narrow space in which we would be sitting would become more and more basic in character as hydroxyl ions were released.

These OH ions would start combining with other ions in the vicinity and some of these basic compounds would even start depositing with the gold. By this time the gold crystals would be so small that most of the shorter wave lengths of light (violet, blues and some green) would be lost by absorption and scattering and we could see only the longer wave lengths (yellows and reds) so the deposit would look almost pinkish. If the plater turned down the rheostat another notch, more and more of the dark-colored basic compounds would co-deposit with the gold and we would start to note a certain fuzziness and roughness (burning) developing around the edges of the test piece where the current density is naturally highest. Another increase in current would result in the direct precipitation of gold hydroxide, and its reduction to gold in a brown, powdery, colloidal form, on the cathode. This is how polarization, brought about by increasing the current density, affects the structure and also the color of the gold deposit.

Agitation

Motion of the work in a gold plating solution has a definite affect on the color of the deposit. If we hold a piece of work motionless in the tank at a current density just sufficient to cause burning, a reddish brown deposit will result. If we take another test piece and plate it at the same current density with the piece or the solution in rapid motion, the color will be yellow, and the deposit unburnt. The effect of the motion is twofold. First, it brings fresh metal to the cathode so that the layers of electrolyte closest to it do not have the opportunity to become depleted of metal (a cause of polarization). This prevents the liberation of hydrogen and the formation of the dark colored basic compounds.

Second, the motion breaks up the tendency of the electrolyte to stratify. In the course of ordinary electrodeposition, metal diffuses down from the anode and up to the cathode as diagrammatically shown in Fig. 11. Naturally, the heavier layers of liquid containing more of the metal tend to remain on bottom and the lighter layers on top, so we get stratification. In the case of gold, the density of which is 19.3, this tendency is greatly accentuated. The heavier ions containing the gold settle down to the bottom even when no current is passed. Though insoluble anodes may be used, the tendency remains, just the same. The bottom layers of the solution, because they are richer in metal, conduct the current better by offering less resistance to its flow and when this is combined with the fact that ends, edges and points always receive more current anyway, we can see at once why long bracelet chains plated in an electrogilding bath look light on top and darker on bottom. Agitation, breaks up the tendency to stratify and thus helps produce a more uniform color.

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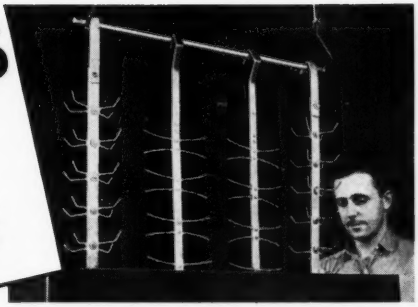

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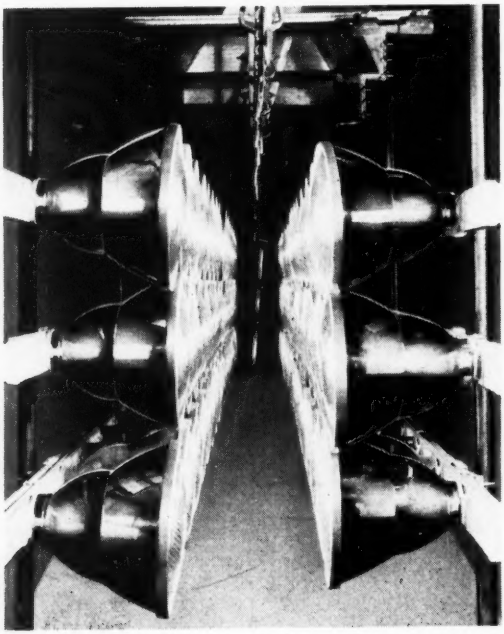
Temperature

In gold plating there is a fairly well defined optimum range of temperature over which the best colors can be obtained. One of the famous six plating commandments handed down by Professor Wilder D. Bancroft many years ago, states that: "lowering the temperature decreases the size of the crystals." In gold plating this effect is not very noticeable, but it is there. Brighter, yellower deposits do result at lower temperatures if the current is kept constant. Increasing temperatures reduce the viscosity of the liquid layers next to cathode, permit the gold to reach it faster and so reduce polarization, and vice versa. In gold flash plating this is not readily discernable because even though the temperature of the baths is high (160-180 deg. F.) reducing polarization and coarsening the crystal structure, the current density is also high (potentials of 6-20 volts are applied momentarily) and the coarsening effect is more than neutralized by the fining effect of the high current density.

Racking

Racking or mounting of the work has an influence on the color of the work in this manner: If we mount a number of pieces one way one time and another way the second time a variation in color may occur because the current density is changed. Some pieces may be nearer the anodes and receive more current, other pieces may be electrically shaded from the anodes and get little or no current so they get no deposit or at best an im-



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mersion gilding. This is an often overlooked factor that causes the color to vary from lot to lot or in the same lot.

Basis Metal

The structure and the color of the basis metal is another factor that controls the color of the gold deposit. Flash deposits of gold are, for all practical purposes, translucent because they are so thin and the color of the basis metal shows right through. On copper, flash deposits appear reddish, on silver they look green and on brass a rich yellow. Therefore, the color of the basis metal must be uniform before gilding. Furthermore, the surface finish must be taken into consideration. A scratchbrushed surface, for example, will generally appear to be darker than a highly polished surface.

Chemical Factors

Gold Content

The gold content of an electrogilding solution has some effect on the color of the deposits inasmuch as it affects polarization at the cathode. With solutions containing higher amounts of gold, metal is not so readily depleted at the cathode and polarization is low, consequently the colors are pale. With lower gold content the metal becomes rapidly depleted and consequently polarization is increased. However, it must be remembered that this holds only for a fixed current density. If we increase the current density in the low metal concentration solution, polarization is increased to such a point that burning occurs. If we increase the current density in the richer solution, the color becomes more yellow and we can safely build up the current density to a point far above that which can be practically used in the weaker solution.

Free Cyanide

With a given amount of gold present in the plating bath, the concentration of free cyanide is a most important factor in determining the color of the gold deposit. In the literature on the subject, conflicting statements are made with regard to color and free cyanide. Some writers say that increasing the free cyanide content of a gilding bath results in paler colors; others say that increasing the free cyanide results in redder colors. Whom are we to believe? The chances are that each of these authors was right within the limits of his experiment and for this reason: Increasing the free cyanide content of a gold plating bath at a fixed current density will, up to a certain point tend to give finer deposits because the ionization of the gold is suppressed by the common ion effect. This reduced ionization (see Part 2 of this series) increases polarization and so the deposits will appear richly yellow. However, if a fixed potential is applied across the bath the current will not remain constant and will increase as additional cyanide is added because this cyanide cuts down the electrical resistance of the bath. Soon a point is reached where the effect of the higher current density completely overshadows everything else and the deposits will be reddish.

If cyanide salts were less prone to decomposition, a great deal of the gold plater's troubles would be over. But unfortunately this is not the case. Cyanide never remains constant in a gilding bath because it reacts vigorously with practically any chemical that happens to be in the immediate vicinity.

First, cyanide is driven off from a

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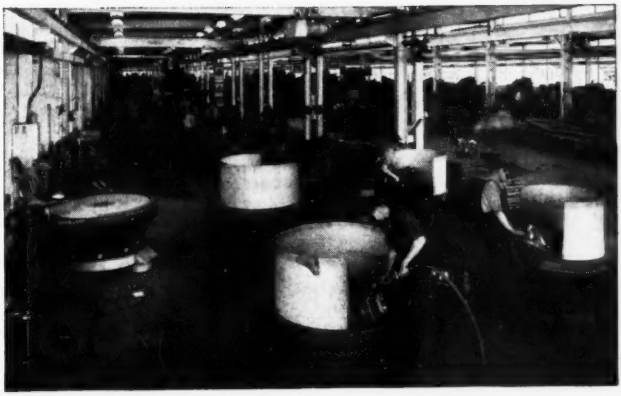

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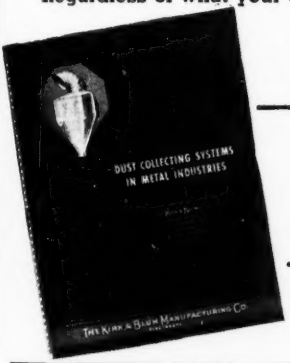

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gold solution if it comes in contact with materials containing acid or acid salts. In fact, such a weak acid as carbonic acid may react with cyanide and drive off HCN. But the carbon dioxide content of most urban water supplies is quite low and the carbon dioxide content of the air is even less than that, except in highly industrialized areas. Doubtless little has to be worried about on this score.

Probably the most important decomposition reaction that must be considered is this one:

$$KCN + H_2O + KOH + \tfrac{1}{2}O_2 = K_2CO_3 + NH_3.$$

The potassium hydroxide is produced at the electrodes and combines with the cyanide and oxygen to form carbonates.

An hydrolysis of cyanides to formates, which may occur under certain conditions is as follows:

$$KCN + 2H_2O = HCOOK + NH_3.$$

Also, a type of hydrolysis which is frequently mentioned in the literature on the subject is as follows:

$$KCN + H_2O = HCN + KOH.$$

Only a very small percentage of cyanide must be driven off this way though because if it were noticeable at all a lot of the boys I know who hang over steaming gold plating pots all day long would be pushing up the daisies by now.

Because of the above mentioned reactions, a pot of cyanide if left in the open and exposed to the air at room temperatures will lose a great deal of strength in a few days. It can easily be seen that at the temperatures at which flashing is performed (160-180 deg. F. or more) the cyanide will go pretty quickly, and unless it is properly replenished the color will be lost likewise.

Carbonates and Other Salts

The rapid formation of carbonates decreases the resistivity of the solution and permits more current to flow at a given potential. This increases polarization and unless current is reduced, burning occurs. Furthermore, after the saturation point is reached, carbonates begin to precipitate with a peculiarly deleterious effect on the color.

Other compounds such as phosplates and so on, affect polarization by increasing the complexity of the gold ion and so change color, or they increase the conductivity of the solution and affect polarization in this manner.

Addition Agents

Certain addition agents even when added in small quantities have remarkable effects on the color or brightness of electrodeposits, and gold is no exception. These compounds which may be crystalloids or colloids, organic or inorganic, have profound effects on the character of the deposit. By codepositing, or interfering with crystal growth, the plated metal crystals become smaller and orientated in a fixed manner.

pH

As mentioned in Part 3 of this series, the pH of the pure gold bath is a minor factor in determining color but this is so because the gold bath is very well buffered. The pH of the film adjacent to the cathode is of great importance however and the general rule is that a lower pH in the cathode film means a greater tendency to hydrogen evolution and polarization of this type. In the alloy gold bath pH is of importance so

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it will be considered further under this topic.

Contaminants

Other heavy metals, particularly copper and zinc from dissolving brass, and iron from corroding, supposedly "insoluble" anodes have a pronounced effect on the color of gold deposits. But here we have what amounts to alloy plating, a subject which will be taken up in the next chapter.

The factors that have been enumerated here are the cause of most of the plating headaches when it comes to color matching and are the factors we must deal with if we wish to establish color uniformity. Most of the practical platers get over these hurdles by stunts and tricks of the trade, but eventually their sins catch up with them and they get into a mess of trouble.

How can these factors be scientifically controlled? As one of the comedians on a currently popular radio program says: "It isn't easy." Scientific control can be established, however, and control methods will be described in detail with our discussion of alloy gold plating.

Lacquer and Synthetic Finishes. A 525-page handbook on lacquer and synthetic enamels, written by Ray C. Martin, Research and Development Chemist, is now being published by the D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City. This book covers in the most up-to-date and practical way raw materials, manufacturing processes, equipment, methods of application, testing, and analysis.

All the facts required by workers with lacquers and synthetic enamels have been provided for instant use by an expert in this field. He gives the fundamental data about all the raw materials, natural and synthetic—and about methods of manufacture, testing, and application of these coatings on various surfaces and in various ways—with all the practical details obtained by broad experience in every phase of the lacquer industry.

All the important methods and materials in use today are covered in this complete manual. The author gives the latest information about the uses and the functions of each material. The book emphasizes consistently the many practical details that must be known in order to obtain the best results with the various products, the different surfaces to which finishes are applied and the various methods of application.

This book covers all the necessary scientific data and principles, including chemical formulas, chemical and physical properties, and so on. All this information is arranged in such a manner that it can be easily found and applied. Among the outstanding features are the comprehensive explanations of formulation requirements, and of methods of testing and analysis.

"Lacquer and Synthetic Enamel Finishes" is 6 by 9 in. in size, cloth bound, and fully illustrated. It is available at $5.50 per copy.

Installation and Maintenance of Electric Motors. By E. Molloy. Published by Chemical Publishing Co., Inc., 148-D Lafayette St., New York, N. Y. 180 pages, 110 illustrations, 4 tables.

A practical treatise for installation engineers, plant engineers, and electricians, this book is designed to acquaint factory men with the task of installing and maintaining electric motors of all types, ranging from fractional horsepower to several horsepower. Discussed in turn are Installing Small Motors, The Installation and Erection of Medium and Large Sized Electric Motors, Wiring and Starting Electric Motors, Care and Maintenance of Electric Motors, Bearings and Lubrication, and Sliprings, Commutators, Brushes, and Brushgears. A feature of special interest is the large number of starter wiring diagrams included in the chapter on "Wiring and Starting Electric Motors."

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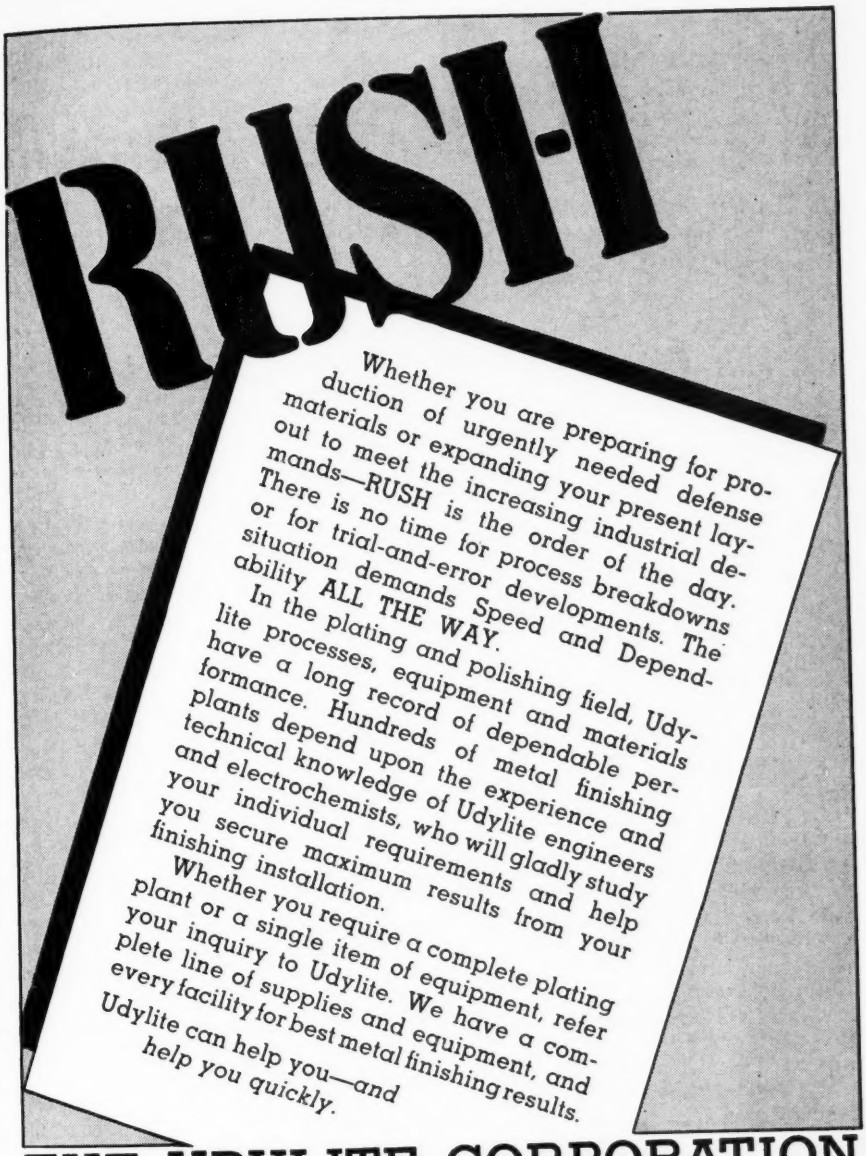
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Factors To Be Considered In Loading Burnishing Barrels

By H. LEROY BEAVER
Lansdale, Pennsylvania

IN the November issue of PRODUCTS FINISHING we discussed at some length the various factors relative to unloading of various types of burnishing barrels with the promise that this month we would in turn discuss the equally important factor of getting the burnishing material back into the barrel after the completion of each load of work. This factor is equally important because much material as well as time may be wasted in this operation.

We suppose that country wide, the most commonly used practice for returning burnishing material to the burnishing barrel is by way of the ordinary scoop shovel route. We sometimes marvel at the ingenuity of some barrel operators in their selection of the multitude of variety of shovels they use for this important work. Very strongly we suspect that many of these shovels are either requisitioned from the boiler room or from some other quite vague source where initially they were intended for quite some other and different purpose than handling steel burnishing materials.

We have examined this subject rather critically over quite a long period and we find that the scoop capacity of the average shovel used in this work would be roughly eight quarts. As a general rule the barrel operator will try to gather up as much material per shovelful as he possibly can. He does not realize the weight of steel burnishing materials and thus he undertakes to accomplish entirely too much at one time and very often with disastrous results. The average burnishing barrel when its opening is in position for re-loading will locate that opening at roughly four feet from the floor level. A loaded eight-quart shovel simply means that the operator is undertaking to lift approximately 100 lbs. of burnishing material to a height of four feet in order to replace it in the barrel.

While research has been conducted on a very wide range of subjects, it is not so generally known that research on the use of shovels for various types of work has also been covered quite carefully, and one of the conclusions reached is of more than passing interest when taken in

its course in the present discussion.

As an illustration let us note the following observation: If the handler of a shovel weighs 150 pounds, then if he uses a shovel that carries a load equivalent to one-third of his own weight, in this case 50 pounds. After he has raised this shovel above his own waist line, the shovel for all practical purposes is considered to be out of control, but when most barrel operators are required to raise their shovels almost shoulder high what can we be expected to say with respect to the control of the shovel at this height.

It is one thing to load a shovel of coal or other rough material and toss it into a bin or fire door, but we have quite a different material when we stop to consider steel burnishing balls or steel burnishing forms. Any reader we feel will readily agree that a scoop shovelful of water would be a difficult and contrary thing to handle if he wished to deposit the water in one given place, but water would be no more difficult than the average burnishing material mass. We have repeatedly said that a burnishing material mass though mobile is not liquid, and yet it flows quite as readily as any liquid would flow when handled with a shovel.

A slight tilt of a shovel either to right or left will cause a sudden surge of the burnishing material and unless the handler of the shovel has a very tight grip on the handle and extreme strength of wrist, the probabilities are that the sudden surge of the mass will cause the shovel to tip with the accompanying spillage of all or most all of the material on the shovel. This means that, depending on the size of the shovel and the load of material in its scoop that anywhere from 50 to close to 100 pounds of material is scattered over the floor in the barrel finishing department. True, much of it may be immediately gathered up, but with an inexcusable waste of production time, and the more serious consequence that much material that rolls away into obscure corners may not be salvaged until it has become rusted. When this rusted material is added to the burnishing mass the

Fig. 1 — An illustration showing two rather handy devices that are used quite extensively in barrel finishing work to load the barrel with burnishing material.

only thing possible to happen is scratches on the work caused by the sharp edges of the rust pits on the burnishing material.

When we consider that in many cases where slatted floors are used

Fig. 2—A pail with one or more sides flattened will aid considerably in removing all burnishing material from the unloading pan or container.

in the barrel finishing department and where much of the spilled material is actually lost for further production use, the cost of shovel application as it relates to spillage is far too great. When we consider that steel burnishing material might be said to average at least 25 cents per pound the spillage of a four-quart shovelful or 50 pounds involves an immediate loss of $12.50 to the operator of the business.

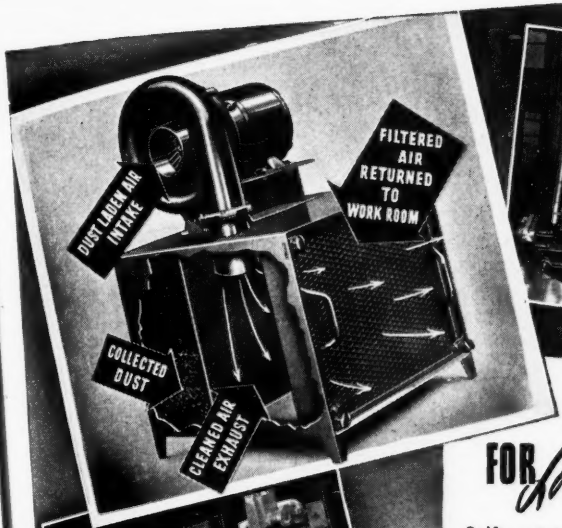
Go with us if you will in the several hundreds plants we have visited in the past few years and note the contrariness of most everything involved with this factor of loading and unloading materials. It is not unusual to find a shovel eight inches in width being used on a barrel with a 16 inch opening, which is quite all right, but on the other hand it is just about the average rule to find a 12-inch shovel being used on a barrel with only an eight inch opening. We do not undertake to explain this, but simply state it as a fact.

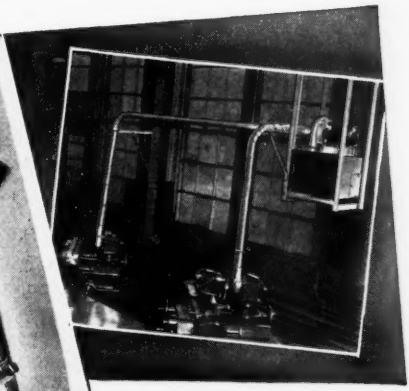
Using a 12-inch shovel on a barrel with an eight inch opening will produce just exactly the condition we have previously noted, that is, in emptying the shovel it is necessary to tilt it and pour the material from one side of its lip, and in this tilting operation we find most of the slips occur due to the sudden surge of the material toward one side of the shovel which results in spillage. And all of this dictates the very simple rule that the lip of the shovel used for loading burnishing material into the barrel should be no wider than the barrel opening itself.

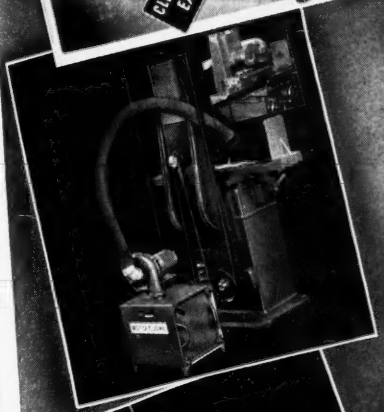
For the same reason, no shovel should be used that would carry a heavier load of material than could be easily lifted to the barrel opening by the average operator. True, a barrel might not be reloaded quite so rapidly, but the saving in spillage and the loss of production time and burnishing materials will amply repay the small difference in time required when the smaller shovels are used. And to those of our readers who are addicted to the large boiler room type of shovel we would suggest that the shovel be returned to its proper place and be replaced by one more applicable for the purpose.

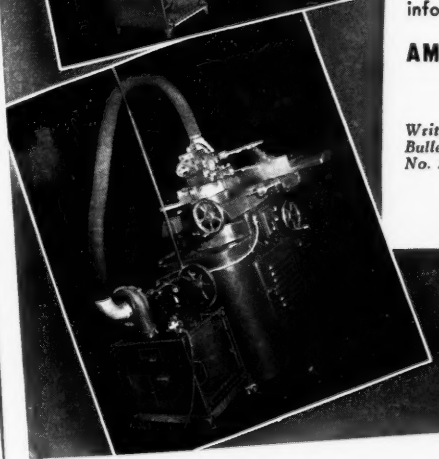
Now, the average reader will say, well if a shovel is so unsatisfactory, what should we use. We have tried in this series to be as constructive as possible and not to condemn a thing unless we felt there was something better to take its place. This brings us to Figure 1. It is a quite simple figure that everyone can understand because it simply illustrates an ordinary scoop shovel of a type largely used in barrel finishing work, and an ordinary eight-quart galvanized bucket or pail, the cost of the latter in the open market being about 25 cents.

If, instead of the shovel, the pail is substituted, it will be found that the average load of burnishing material than can be scooped up at one load will run from 50 to 60 pounds. This may be quite easily lifted in the









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pail to the rim of the barrel and poured into the barrel with no loss whatever and far less fatiguing on the operator. The only difficulty in using the pail "as is" lies in the fact that toward the end of the load, the curved rim of the pail will provide some little difficulty in scooping up the last few pounds of materials, but this is quite easily overcome by simply flattening down one side of the pail substantially as shown in Figure 2.

This is not a difficult procedure and can be easily accomplished in any shop. It is suggested that a pail be selected that has a wood handle in the center of the bail since this is far easier on the operator's hands than the plain wire bail. In some cases we have noted where the operator has also riveted a small handle to the rim of the pail at the bottom edge to provide greater ease in handling. We know of no instance where we have recommended the use of a flat sided pail as against any type of shovel whatever, that the operator did not almost immediately become enthusiastic over the pail, and we know of no case, that once the pail was adopted that the operator ever went back to the shovel practice. These observations and recommendations, of course, more especially apply to those installations where only one or two barrels are used, and where more elaborate loading apparatus is not indicated.

Coming now to installations where anywhere from 10 to 20 barrels are lined up in a row in the barrel finishing department, and indeed such installations are not so uncommon as might be believed, we find a wide variety of methods for loading, even though the unloading factors are more often neglected. Principal of these is the overhead single tram rail carrying in most cases an elec-

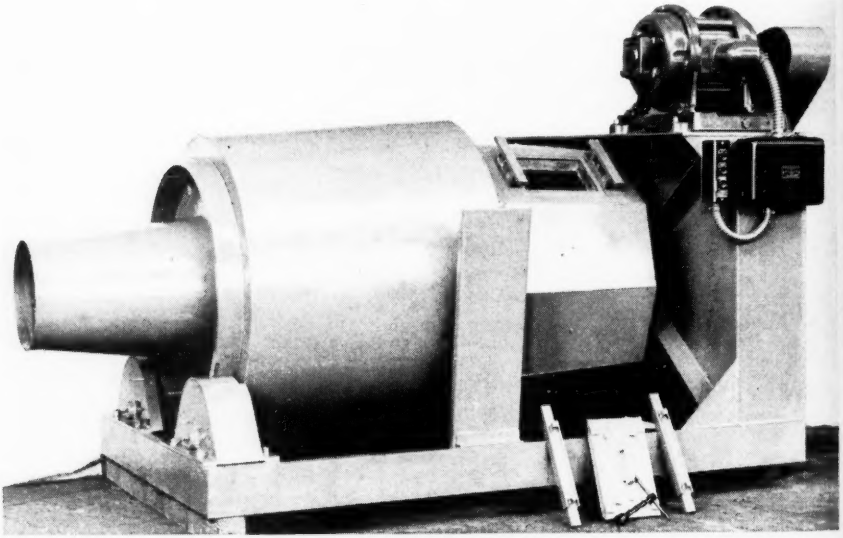
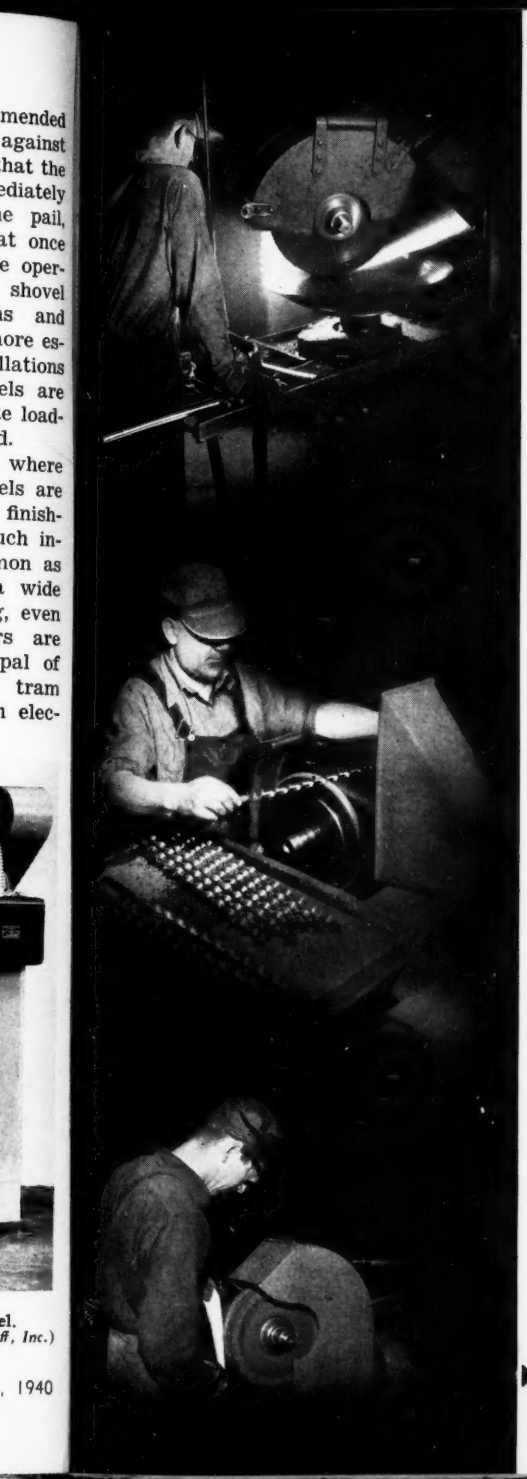


Fig. 3—Illustration showing a side loadiing and unloading ball return burnishing barrel. *(Photo Courtesy N. Ransohoff, Inc.)*



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tric hoist or a chain block. The unloading pan is in these cases of heavier construction and fitted with lugs to which a chain or clevis may be attached and the entire load hoisted and returned to the barrel.

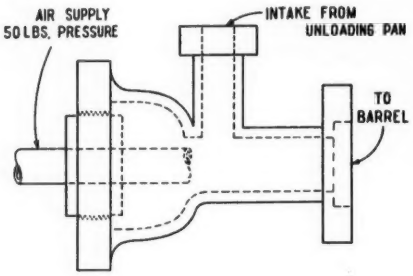

Fig. 4—A standard pipe connection can be converted into the operating head shown here for use with a simple burnishing material loading device.

Then, we have one manufacturer who produces what is termed a "batch loader" which may be used either for loading burnishing materials or parts to be processed. An illustration of this type of unit is shown in Fig. 3.

At other times down through the years there have been various attempts to produce a loading device operating with a series of buckets mounted on an endless chain, but practically all of these devices have been expensive to build, cumbersome to move around and slow in operation, and for this reason they are only found in isolated cases, no two alike, and mostly built according to the ideas prevailing in some particular plant. Having once built one of them, the investment was too great to discard or junk the instrumentality which probably accounts for the continued use of most of the loading gear of this type.

In a previous paper in this series we briefly described a process for loading burnishing material into burnishing barrels by using a very simple apparatus that can readily be built in any shop and at a very slight cost, quite out of proportion to its efficiency, and operating with compressed air. We have had many inquiries regarding this hook-up and a very large number of readers of this series have already built and have these loaders in operation. We would deem it quite appropriate to enlarge somewhat on this device in connection with this present discussion of re-loading burnishing materials. The principal fixture for this device is illustrated in Figure 4.

This represents a simple 2½ in. x 2 in. x 1 in. "T" that may be obtained from any dealer in pipe and fittings. It should be the galvanized type. This is the operating head of the device and considering its supreme simplicity is quite important. The "T" is fitted with an ordinary pipe plug in the 2½ in. end. A hole is drilled through the center of this plug and tapped to receive a ½-in. threaded pipe which, after the plug is tightly turned into place, is screwed in until its end is exactly flush with the near side of the 1 in. outlet that leads to the unloading pan, as shown in the sketch Fig. 5. This should be held tightly in place with a lock nut on the inside of the "T" as well as on the outside against the plug, and this is the only critical adjustment.

The ½-in. pipe leading through the pipe plug is attached to the compressed air line and should be fitted with a valve conveniently located to regulate the air pressure. The lead from the unloading pan into the "T" should be as direct as possible to provide for easy gravity flow of the burnishing material into the "T" where it is immediately taken up by the air flow and carried through the

tube assembly into the barrel. From the 2 in. or discharge end of the "T" the balance of the assembly is made from 2-in. pipe or tubing and two bends which should be not less than a radius of 16 in.

Ordinary ells cannot be used as they will cut through very quickly from impact by the steel burnishing material, and it has been found that bends with a 16 inch radius function perfectly in this device. Pressure of from 40 to 50 pounds of air is required, and the device will return 1,000 pounds of burnishing materials to the barrel in from 10 to 11 minutes, or in less time than is generally required to riddle the burnishing material from the parts being finished. Generally, the unloading tray is made to slope from all corners toward the discharge pipe in the corner in which the unloading device is fed. The drain pipe may be right alongside the discharge pipe into the loader and should be screened to prevent loss of burnishing material down the drain. The small amount of water that may drop into the unloader is of no consequence. Indeed if the parts being finished are as clean as they should be, the soapy water lubricant may be blown back into the barrel along with the burnishing material, and with the addition of only a small quantity of soap as a builder can be used several times. This effects an economy in soap.

In order that the reader may visualize this device, we present as Figure 5 an outline sketch showing the device as applied to a high and narrow or Abbott Type of barrel which is in solid outline, and also a long and narrow or Baird type of barrel which is shown by dotted lines drawn through the high and narrow outline.

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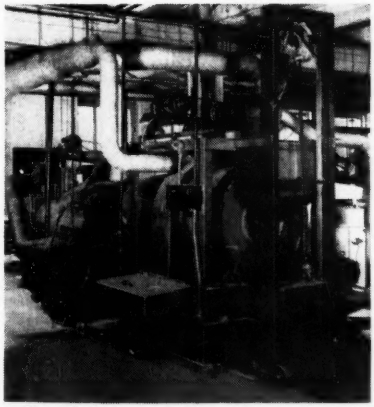

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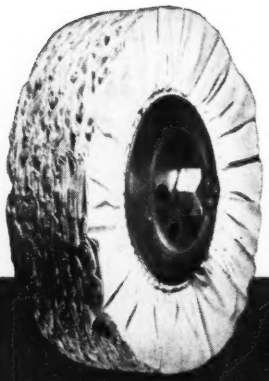

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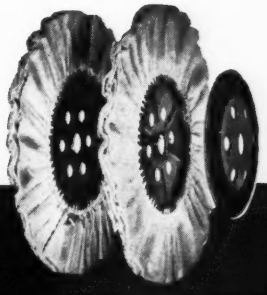

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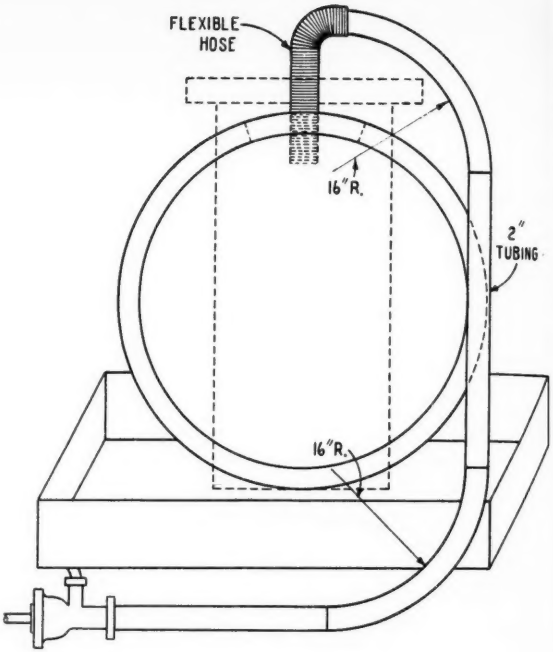

Fig. 5 — Diagrammatic view of a setup with the simple burnishing material loading device described in this article.

For the pipe or tube, regular 2-in. pipe may be used or in lieu of this seamless 2-in. steel tubing. To the end of the tube which discharges into the barrel a section of 2-in. packing hose should be clamped substantially as shown in the sketch, and the end of this hose should project downward into the barrel at least six to eight inches. The riser tube may be fastened to the barrel hanger frame by appropriate pipe clamps, or the entire device may be mounted on a base so that it can be used on a series of barrels, in which case it is simply plugged into the discharge pipe leading from the unloading pan. The entire device is so flexible that it may and should be mounted in such a way so as not to interfere with the barrel operator.

Where stagger loading is desirable, that is, where parts and burnishing material are to be mixed, this can be accomplished by simply adding parts to the barrel while the loader is in operation. In very many cases this is desirable practice and especially so on that range of parts that might be scratched or distorted by being simply dumped into the barrel on top of the entire burnishing mass and left to find their own time to work their way through the mass while the barrel is in operation.

We firmly believe that if the recommendations contained in this and the immediately preceding paper are carefully considered, that they will go far to eliminate the complaints of sloppy, wet and altogether undesirable burnishing department conditions, for which there is absolutely no excuse.

Varnish Making. One of the most complete books on the subject of varnish making is now being published by Chemical Publishing Co., Inc., 148 N. Lafayette St., New York, N. Y. The particular aim of this book has been to correlate the physical and chemical changes taking place in varnish making.

Up-to-date material has been included, such as new synthetic drying

oils and a new approach to the study of the changes that take place during film formation. Formulas, diagrams, tables, and photographs bear out the text.

The content of the book is as follows: History of Varnish Manufacture; Introductory Paper; Drying Oils in Relation to Varnishes; New Synthetic Drying Oils; Maleic Acid Resins; Some Physical Aspects of Resin and Oil Systems; Chemical Reactions in Varnish Making; Alkyd Resins; Some Observations on "Oil - Reactive" Phenol - Formaldehyde Resins; Preliminary Observations on the Oxidation and Polymerization of Drying Oil Varnishes in Thin Films by Surface Potential and Other Methods; The Occurrence and Chemistry of Agathic Acid; Methods of Heating Used in the Manufacture of Varnish; Factory Hazards; Fume Condensation; Filtration and Aging of Varnishes; Modern Plant for Oil and Varnish Treatment; and The Accurate Measurement of Temperature.

The price of this book is $6.00 per copy and the book can be obtained by writing to the Chemical Publishing Co., Inc.

Fostoria Localites—localized lighting units—are the subject of a 24-page catalog released by The Fostoria Pressed Steel Corp., Fostoria, Ohio. Machine, bench, and table type Localites available in single arm, double arm, and special models are illustrated and described. Fostoria Fluorescent and Silver Bowl Canopy Model Localites are also covered in the catalog, and illustrations showing various applications of Localites are included. Copy of Catalog ML-25 free upon request.

Penflex All Metal Steam Hose and Clincher Couplings. All metal steam hose which is said to find particular application from boiler to point of use is described in a bulletin now being issued by Pennsylvania Flexible Metallic Tubing Co., 72nd St. and Powers Lane, Philadelphia, Pennsylvania.

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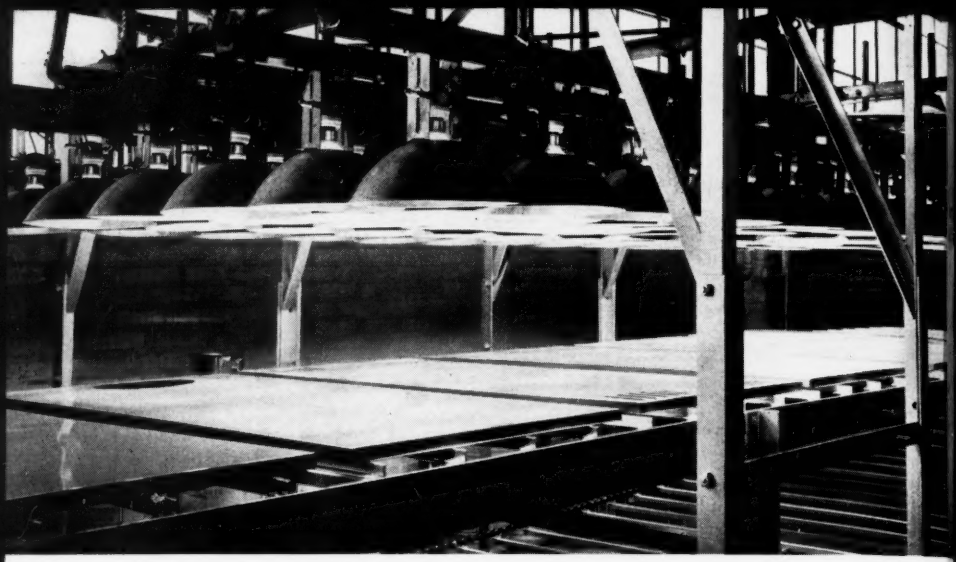


HERE is how Ault & Wiborg Polymerin is baked on sheet metal at the Anchor Post Fence Co., Baltimore. This bank of 72 infra-red, adjustable focus, lamp units does the job in 8 minutes. The steel sheets are jacket panels for oil burners.

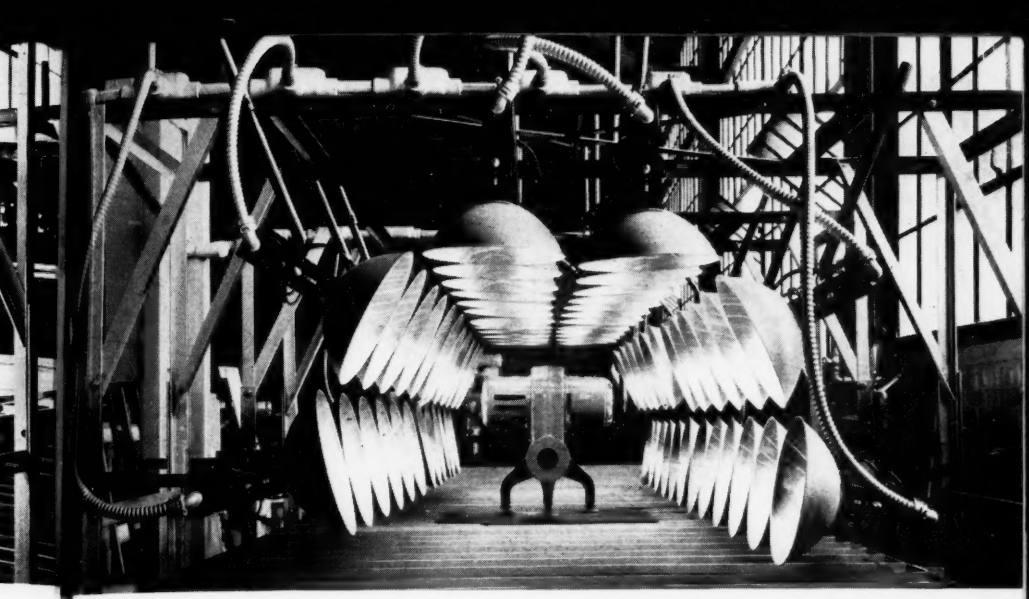
FAST FINISHING WITH IN

AN interesting application of an infra-red finishing system is found at the Anchor Post Fence Company, Baltimore, Maryland, where the finishes on both completed oil burner units and large jacket panels are baked under lamps. Anchor Post Fence manufactures a fluid heat oil burner, in addition to its line of steel fence sections.

The jacket panels for the heaters are constructed of 20 gauge steel. During the finishing procedure, the operator in the spray booth applies a priming coat on the under side of a panel and a coat of Ault & Wiborg Polymerin on the upper side. Over the Polymerin, a hammered-effect enamel known as Polymeroid is applied to give a desired "hammered-effect," and the panel is then ready for baking.

With infra-red drying lamps of the type illustrated herewith, the baking operation requires eight minutes, the primer on the underside and the Polymeroid being baked simultaneously. The oil burners are finished with a Polymeroid finish in very much the same way, the baking cycle for these units being 16 minutes. The equipment required occupies a space 30 feet long and five feet wide.

The conveyor carrying the sheets moves at the rate of one foot per minute, a speed synchronized to the spraying output. When the sheets reach the unloading end, they are cool enough to handle. No preheating of the oven unit is required. Full



COMPLETE oil burner units, finished with Ault & Wiborg Polymerin, are baked in this infra-red lamp bank at the Anchor Post Fence Co., Baltimore.

TH INFRA-RED SYSTEM

application of the heat follows the instant the lamps are turned on. The cost of operating the oven is estimated at 20 cents per hour. The resultant finish on the oil burner panels and the oil burners is reported to be tough, durable, and uniform.

Ferro Celebrates Twentieth Anniversary. Ferro Enamel Corporation, 4150 E. 56th St., Cleveland, Ohio, manufacturers of inorganic and organic finishes, colors, porcelain enameling furnaces, ovens, and allied products, announces its twentieth anniversary, through a leaflet being distributed in the porcelain enameling field and signed by Mr. Robert A. Weaver, president of the company.

Pictures in the leaflet show the company's 1920 and 1940 plants. A chart tells that shipments of Ferro porcelain enamels have increased from 59,000 lbs. in 1920 to an estimated 59,000,000 lbs. in 1940. Furnace installations made in 20 years total 80 continuous and 500 box-type furnaces.

Also included are illustrations and brief histories of Ferro's foreign plants, of which there are seven.

Mr. Weaver appropriately prefaces the leaflet's contents with the statement that the world has changed a lot since 1920, when Ferro first opened its doors and that, therefore, the company feels a brief review of its growth in 20 years would be interesting.

Copies are being sent to Ferro stockholders, as well as to customers and friends. Copies may be obtained from the company free upon request.

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THE REPAIR OF HOT-DIP GALVANIZED COATINGS

Speedy repair of damaged tin and zinc coatings is of utmost importance in highly geared defense production, consequently many will find the information presented here of unusual interest.

By WALLACE G. IMHOFF

President, The Wallace G. Imhoff Co.
Vineland, New Jersey

IT IS perhaps not generally known that there is a satisfactory method now available for repairing hot-dip galvanized coatings. There are many instances when the protected surface of galvanized articles and equipment may be damaged during assembly operations such as welding, forming, bending, riveting, threading, abrading, and fabricating. The zinc coating may be removed entirely in certain spots by one or more of the above operations, or perhaps some defect in the coating may develop during galvanizing operations. Thus it becomes very important to be able to mend or repair a zinc coating at the time it is put on, or even more important to repair a broken, or damaged coating resulting from fabrication or erection of zinc-coated parts. Sometimes damage results even in packing and shipping, and therefore it is of considerable practical interest to know whether there is a satisfactory method by which such zinc coatings can be satisfactorily repaired. The answer is yes, there now is a satisfactory method, or means of repairing hot-dipped zinc coatings.

The repair of hot galvanized coatings may be considered under at least three different conditions which are:

(1) Repair of defective spots in galvanizing.

(2) Repair of defective areas due to some fabricating process such as welding.

(3) Repair of defective galvanized coatings that have been broken or damaged in packing, railroad shipping, or erection of the various parts, such as in structural work.

An additional, or fourth consideration might be the re-coating of pipe and conduits, railings, and so on, or metals that have been threaded. A brief discussion will be given regarding all four cases.

Attention is at once called to the fact that repairing of zinc coatings, the subject of this article, is not to be confused with an entirely different thing, the welding of galvanized coatings. The methods herein described are not for large scale work,

or bulk work, but rather for the field which is classed as repair work.

The material used is a commercial product, and may be purchased on the open market.* It is in powdered form, and has now been used for a number of years by many galvanizing plants.

The method of application is simple. The spot to be repaired is covered with the powder, or it may be used in paste form. It is then heated. A blow torch, or welding torch is used for heating. When the heat is applied the spot is continuously coated, and the finish is comparable to the original galvanized coating. As a general rule, no preliminary cleaning is necessary. If the spot seems to require some cleaning treatment it may be swabbed with muriatic acid. This will remove the worst foreign material. The one exception to the general practice is found where gas welding has formed a highly vitreous oxidized scale. This heavy oxide vitreous scale must be completely removed before applying the powder.

It is now of interest to discuss the various classes of work that such repair work can be done on. The first condition is the repair of defective spots in hot-dip galvanizing. It is well known to all practical men in galvanizing that regardless of how careful the operators may be, from time to time pieces come through that have places on them where the zinc coating has not "taken." In one case it may be just a "skip" on an open surface; in another it may be a corner, or some other place a little less accessible for the metal to flow into; in still another it may be a flux spot, or black spot; and then there

*Amco Galvanizing Powder, American Solder and Flux Company, 2152-54 E. Norris St., Philadelphia, Pennsylvania.

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are times when seemingly for no reason at all, bare and exposed steel spots occur; and finally there is the case of oxide, scruf, and dirt in the coating which often is accompanied by areas not perfectly coated with zinc. All of these conditions may be perfectly repaired by the use of this galvanizing powder now on the market.

The second condition covers various kinds of fabricated work that must be repaired because of welding. Tanks, gates, structural steel, fences, flag poles, broadcasting towers, and many other like examples fall into this class. The main factor of importance in this type of repair work is that the heavy, blue, siliceous welding scale be entirely removed before attempting to repair the zinc coating. This kind of scale prevents the repair reactions from taking place by forming an insulating layer between the base metal, and the repair material. It is impossible for the repair process to overcome this vicious siliceous scale. Hence on all welded repair work great care must be exercised to see that the welded area is absolutely clean, and free from all of the welding scale.

The third condition of repair work covers all of those cases where galvanized articles have been damaged in shipping, or in transit, damaged by fabrication, by abrasion, or during assemblage. Sometimes these galvanized steel parts have not been packed and crated right; at other times they have been unloaded, and the pieces have been damaged in unloading, or in piling and handling to and from the job; still other cases develop where the zinc coating has been damaged in fabrication. All of these different examples of damaged and broken zinc coatings are suitable for perfect repairing by the application of this galvanizing powder method of repairing zinc coatings.

The fourth condition of repairing zinc coatings comes under the class of repairing various kinds of articles that are to be threaded. For example, in some cases pipes are galvanized over their entire length before they are threaded. They are then threaded at the ends after galvanizing, and this threading operation naturally removes all of the zinc coating protection at the ends. The original coating is put on the pipe to protect it from corrosion, yet here is a later operation that destroys the full value of the protection by removing the coating on the ends of the pipe. The open, or threaded ends are again subject to corrosion. By applying the repair galvanizing powder in the form of a paste around the threads, and then heating it to the proper temperature, the protective zinc coating is again restored without any damage to the threads, and also with a tight permanent bond to the base metal. In addition to repairing threads, the same general application can be made upon railings, conduits, and so on.

There has long been a need for a completely satisfactory method of repairing zinc coatings. The difficulty has been due to the fact that zinc is a low melting point metal (zinc melts at 786 deg. F.) and the high heat of the acetylene torch volatilized, or burned the zinc up, changing it into the oxide before it could be properly bonded to the base metal. All of these former difficulties are now eliminated by this new method of repair with galvanizing powder.

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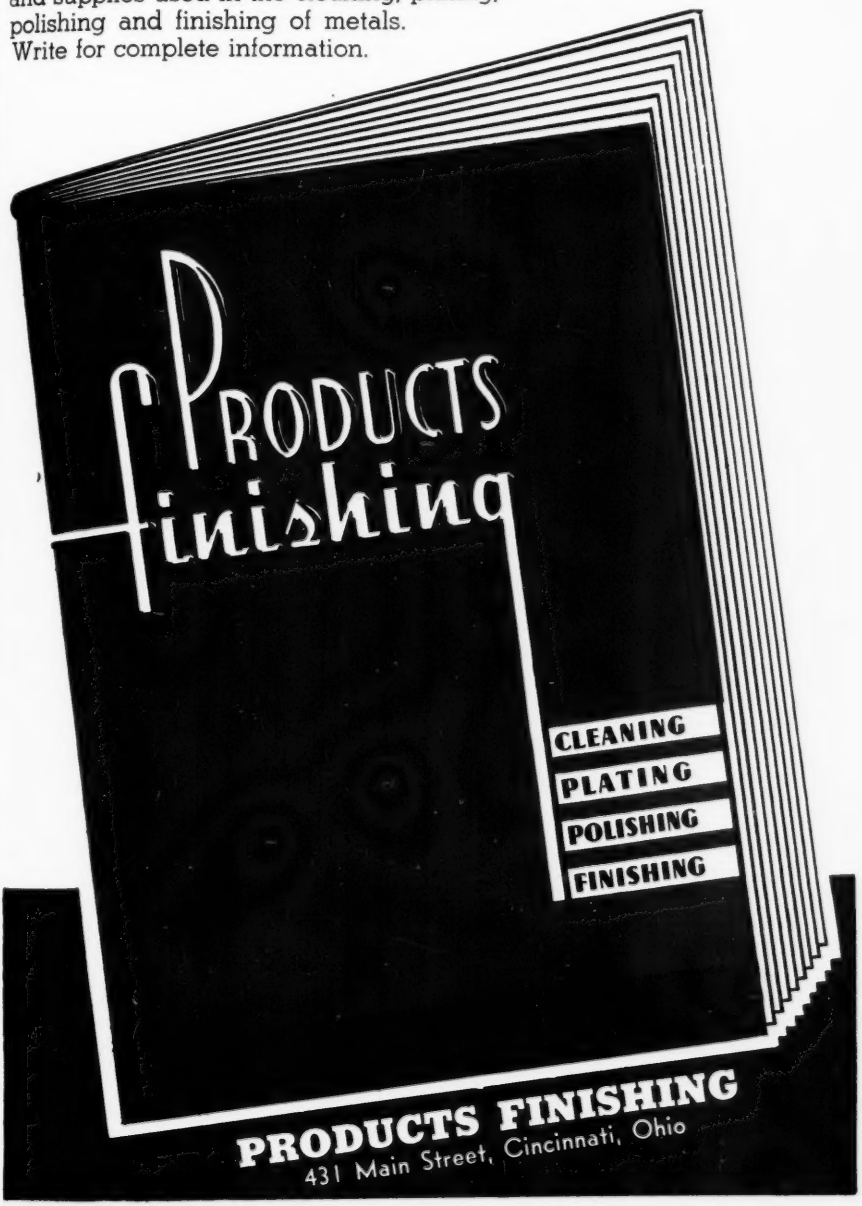

Fig. 1—A view of the battery of 12 rubber-lined tanks for high speed electroplating.

HIGH PRODUCTION PLATING IN RUBBER-LINED TANKS

A BATTERY of 12 tanks for high speed electroplating at a temperature of 180 deg. Fahrenheit were recently installed in the plant of the Westinghouse Electric and Manufacturing Company, Newark, New Jersey. A view of the complete installation is shown in Fig. 1 and a close-up of an individual unit is shown in Fig. 2. These tanks were lined with Triflex "K" rubber tank lining, a material recently announced by the B. F. Goodrich Company.

Triflex "K" was especially developed for this type of service since it is non-contaminating and offers maximum resistance to the corrosive effects of plating solutions. The process whereby the lining is applied is a special adaptation of a patented three-ply lining construction originally developed by the Goodrich Company in response to urgent demands for a more durable lining for heavy duty pickling tanks in the steel industry. It comprises a layer of hard rubber construction cushioned between two layers of softer rubber, the three plies being vulcanized together to form an integral structure.

Adjacent sheets of the three-ply material are overlapped to form expansion joints in which the hard rubber layers are separated. This construction permits the tanks to be operated at wide variations of temper-

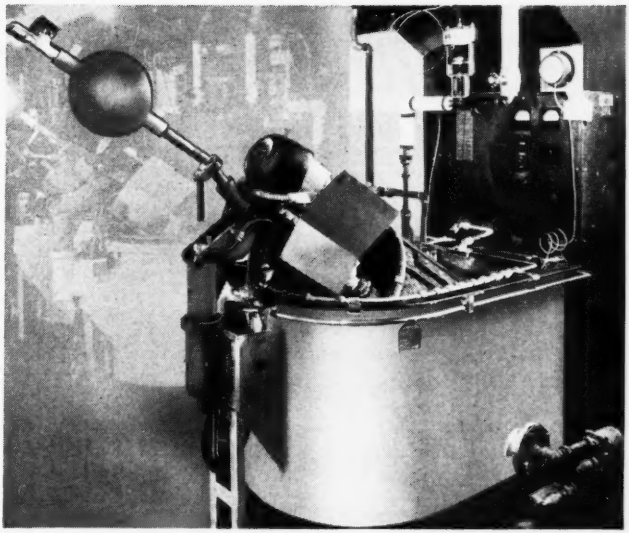

Fig. 2 — A closeup view of one of the rubber-lined electroplating tanks now in operation at the Westinghouse plant.

•

ature without damage to the lining by expansion or contraction.

Practical Pumping Problems and How They Are Solved. A new illustrated booklet containing comprehensive information on pumps and pump parts, published by The International Nickel Company, 67 Wall St., New York City, has recently come off the press.

This 16-page folder, "Practical Pumping Problems and How They Are Solved," discusses in detail the uses of Monel, "K" Monel, and "S" Monel for pump parts in applications where there is need for high resistance to corrosion, wear, pitting, or scoring. This includes different types of pumps, such as reciprocating, centrifugal, and rotary pumps.

Part of the book is devoted to a review of case histories. Complete performance data are given on pumps in various applications which suggest how sizable savings can often be made in maintenance and replacement costs. Much attention is given to the choice of suitable materials for pumps handling a variety of corrosives in a wide range of industries, including power, chemical, municipal water supply, processing, railroad, steamship operation, and other diversified fields.

The booklet, which is of a semi-technical nature, was prepared in collaboration with S. A. Tucker and F. A. Annett, associate editors of "Power." Copy will be sent free upon request.

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HEALTH HAZARDS IN THE FINISHING OF METALS

PART II-- Poisons

By N. E. Promisel

Industrial Consultant, Brookline, Massachusetts

IN A PREVIOUS article a variety of factors in industrial health hazards were described. Many of these are especially applicable to that important type of industrial hazard included under general poisoning. To briefly repeat some of these factors, the following are listed: Sex, age, race, living habits, personal idiosyncrasies and diet. These contributory influences, however, generally affect only the degree to which toxic substances react upon individuals; rarely are they responsible for immunity. As a result, while it is impossible to safely set specific limits of concentration above which a substance will have injurious effects on health, it is safe to draw conclusions about its general danger and toxicity.

Of a similar consideration is the fact that experiments upon toxicity are necessarily limited almost exclusively to animals so that except where cases of poisoning unfortunately do occur in industry to confirm such experiments, results on human beings may be either milder or more intense, but apparently never contrary. It is true also that industrial poisoning is usually of the chronic type, beginning mildly and gathering strength over periods of continued exposure. Not very often is it acute i.e. very severe but short-lived. For this reason, poisoning may actually be occurring without being generally recognized until it has reached an advanced stage, indicating the importance of periodic medical examination where toxic substances are being used.

Because of the great variety of substances used in the plating and finishing industry, some division of the subject is necessary and the following has been selected:

(1) Organic solvents.

(2) Gases and fumes, excluding those associated with (1).

(3) Common metals.

(4) Inorganic compounds.

(5) Organic compounds not dealt with above.

Organic Solvents

For our purposes, organic solvents are used primarily for cleaning (degreasing) and in connection with lacquers, paints and varnishes or their removal. It is convenient to subdivide them according to their chemical composition as follows:

1. Hydrocarbons (not chlorinated) of which familiar examples are benzene (benzol), benzine, naphthas, turpentine, and so on.

2. Chlorinated compounds of which our most important are illustrated by trichlorethylene and carbon tetrachloride.

3. Alcohols and ethers. While the alcohols are too well known to need illustration, the ethers travel incognito much more often under such trade names as the Cellosolves, Carbitols and Dioxan.

4. Aldehydes and ketones such as acetaldehyde and acetone.

5. Esters such as amyl acetate (banana oil) used in lacquers.

6. Miscellaneous.

A tabular summary of the effects of the above on health and a description of precautionary measures are given at the conclusion of this chapter.

1. Hydrocarbons (Not Clorinated)

These hydrocarbons belong to either the aromatic series containing benzene, toluene, xylene and compounds derived from them or to the aliphatic series containing the petroluem distillates. The former group is definitely more poisonous than the latter acting primarily on the blood-forming organs of the body. Respiration is the main means of entrance into the body although some may also be absorbed through the skin, especially if they are good solvents for fats. In addition, there is a tendency for them to cause skin diseases, either directly or indirectly by removal of the protective body oils. The indiscriminate use of solvents by workmen for washing their hands is not to be encouraged therefore. These solvents are usually highly volatile increasing the danger from them, and they are all a fire hazard. Being heavier than air, they may settle in corners of the room, in-

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creasing the danger of fire and explosion.

Benzene (Benzol)—This material is one of the most dangerous of solvents used in industry. This very fact, however, has persuaded many employers to abandon its use so that the number of actual cases of benzol poisoning has greatly diminished, although still remaining significant. It is important to differentiate between the two words benzEne and benzIne, which unfortunately are commonly pronounced the same. Benzene (known also as benzol) is a particular coal tar product and benzine is a mixture of hydrocarbons distilled from petroleum.

The commercial benzol is not usually pure and often contains appreciable toluol. It is a colorless liquid practically insoluble in water, with a not very unpleasant odor, burns easily with a smoky, luminous flame and is very volatile (about one third as volatile as sulfuric ether). It forms an explosive mixture with air in proportions of 5 to 8 per cent, which may be ignited by either an open flame or a spark. It is a good solvent for oils, greases, gums, resin, and many cellulose compounds (but not the acetate or nitrate). Its uses which justify consideration here include general degreasing, paint removers, oil extraction, rubber solvent, and dye manufacture. Its use in the paint and lacquer industry has practically disappeared.

Benzol poisoning, when acute, has a destructive effect on the entire central nervous system. In chronic cases the effect on the general system is relatively slight but the blood-forming system of the body degenerates. The general and typical aspects of benzol poisoning therefore involve destruction of the red and white blood cells, increasing anemia, a feeling of tiredness and weakness, bleeding and hemorrhaging and eventually death. Many variations of these features do occur, however.

Because inhalation is the chief method of absorption, the high volatility of benzol is particularly significant. For example, cleaning benzol containers in closed spaces may be very dangerous. Flushing with water may increase the danger by spreading it on the walls where it easily evaporates. Cleaning with steam, with proper outlets for the steam and the benzol-containing condensed water, is much better.

Physical exertion and excitement, low vitality and respiratory diseases, increase susceptibility to poisoning.

TABLE II

Concentration of benzol vapor in air (in parts per million)	Effects
19,000	Fatal in very short time.
3,130-4,700	Maximum concentration for exposures of ½-1 hour.
1,570-3,130	Slight symptoms with exposures of several hours.
100	Maximum allowable concentration.

Effects of Benzol Vapor

(From a table in Mech. Eng., 1935.)

It is questionable whether sex or age have any particular effect, although youth, especially in women, may suffer more. If poisoning is to occur, it usually happens in the first year. Individual susceptibility may vary very markedly. It is important to remember, too, that once this poison has started, it may continue even though the individual is no longer exposed.

In Table II the effects of various concentrations of benzol vapor in the air are given. A strength of 19,000 p.p.m. (parts per million) is rarely met with in industry (even a dry cleaning plant in summer showed only 4,000 to 5,000 p.p.m.). However, of about 120 factories investigated, almost three fourths had concentrations above the permissible maximum. On the other hand, a few hundred p.p.m. can be definitely smelled so that if an odor of benzol is detected, it means that continued exposure may prove harmful.

Toluene (Toluol)—This is a colorless liquid similar to benzol in its properties (in fact chemically it is methyl benzol). Its odor is a little sharper and its volatility a little less (about one sixth that of sulfuric ether). It is frequently used in industry as a substitute for benzol, in about the same fields. So-called solvent naphtha and hi-flash naphtha are really mixtures of toluol, xylol and heavier hydrocarbons.

Generally speaking, acute and chronic poisoning due to toluol show effects similar to those with benzol but to a less degree. Thus, the safe maximum concentration is considered about twice that of benzol. Unconsciousness in acute poisoning, for example, is comparatively rare and very few fatal cases of pure toluol poisoning have been reported. Al-

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though a little confusion exists as to the toxicity of toluol in man, it appears to be generally true that it is less active than benzol, especially in chronic poisoning, and that danger from it is generally less because of its lower volatility. For this reason it should be used instead of benzol whenever possible. Over a long period of time, it may, however, produce severe toxic effects. It is important to remember also that commercial toluol very often contains benzol which increases the danger.

Xylene (Xylol)—This is another derivative of benzol, containing two methyl groups instead of one as in toluol. Its volatility is even less than either of the two preceding solvents and its flash point is higher, decreasing the explosion hazard. Besides its uses as a solvent for gums it is sometimes used with methylated spirit (mixture of methyl and ethyl alcohols) for degreasing instead of trichlorethylene. It is definitely less toxic than benzol but its toxicity compared with toluol is uncertain. However, remembering too its lower volatility, xylene is usually considered harmless where ventilation is even moderately good. Mixtures of benzol and xylol have proven very dangerous.

Petroleum distillates: benzine, kerosene, petroleum ether, and gasoline—As mentioned above, there exists considerable confusion in connection with these substances, benzene, naphthas, and others and this confusion has also blurred the picture of their toxicity. Fortunately, the toxicity of all the petroleum distillates is about the same so that distinctions between the individuals, such as petroleum spirit, white spirit and benzine, while of some importance as regards usage, need not be considered here. The uses of these materials are similar to those enumerated under the coal tar products (benzol, etc.). They are all solvents for fats, which make them a greater menace to the human body, they are all volatile, and to a more or less extent, they are inflammable. Hydrogenated naphthas, more recently coming into use, are better solvents and often less volatile, but in themselves are probably not less poisonous.

Although, as has been said, the petroleum derivatives are not as poisonous as the coal-tar products, if the exposure is intense, severe cases may result. The effects are headache, blurred vision, mental confusion, intoxication, dizziness, nausea, abdominal pain and sometimes unconsciousness. Fresh air seems to disperse most of these effects. While there is some question as to the exact effect on the blood, it is at least certain that any effect is not at all comparable to that of benzol. The possibility of there being more toxic substances present must not be over-

TABLE III

Concentration of benzine in p.p.m.	Effect
300	Perceptible odor.
1,000	Maximum safe concentration.
11,000-22,000	Dangerous by inhalation for short periods.
24,000-30,000	Rapidly fatal.

Effects of Benzine Vapor

looked, however. A familiar example is the presence of tetraethyl lead in gasoline. Similarly, many benzines, depending on their geographical origin, contain also the more dangerous benzene.

In Table III (mainly from the U. S. Bureau of Mines 1921) are given a few concentrations of benzine vapor in air and the corresponding effects. To indicate what these concentrations actually mean, it may be said that in the neighborhood of apparatus into which benzine was frequently poured the concentration was about 1,000 p.p.m. and in the neighborhood of rubber dissolved in benzine, where about 1,000 pounds of benzine were being used hourly, the concentration reached about 2,500 p.p.m. In both cases, chronic poisoning of many workers existed. In a study of 80 factories, about one-fourth exceeded the safe maximum concentration.

Turpentine — This familiar substance has practically passed out of use in the metal finishing field, being replaced by the petroleum distillates described above or chlorinated compounds. Its present chief use is mostly in house and marine points.

Various grades of turpentine exist: Gum spirit which is tapped from the tree, turpentine steam-distilled from the oleo-resin within or from the wood, turpentine from the destructive distillation of the wood and wood turpentine which is a mixture of the two latter. The commercial grades also often contain naphthas, coal-tar products, resin oils, etc., which may be more injurious than the original turpentine.

Turpentine mainly irritates the skin and the mucous membranes, leading to dermatitis which will be described later. It is generally considered that exposure, even for long

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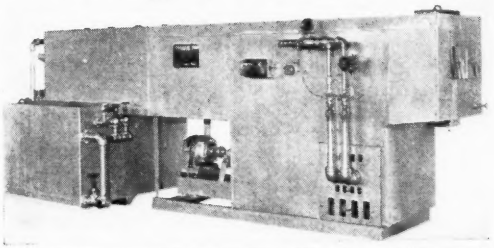

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periods, to atmospheres containing mild amounts of it, does not cause chronic poisoning although there might be temporary dizziness, nausea or stomach ache. If the fumes are heavy, the above effects are of course accentuated, the kidneys may be affected and in extreme cases even some deaths have been reported.

Miscellaneous—Other non-chlorinated hydro-carbons are used in the metal industry such as limonene, napthene, cyclohexanes, tetralin, etc., but for the most part no poisonous effects have been reported for the important ones.

2. Chlorinated Hydrocarbons

These solvents have rapidly come into wide use because of their non-inflammability and because of their wide application as metal degreasers, oil, fat, wax and rubber solvents, thinners for nitrocellulose lacquers and in dry cleaning. Generally, they are poisonous and have anesthetic effects, the introduction of the chlorine into the hydrocarbon having increased the toxicity. Most of the important ones are very volatile so that poisoning is due mainly to their inhalation. The vapors cause irritation of the eyes, nose, throat and lungs; the liquids remove the natural oil from the skin permitting local damage; and the absorbed substances affect the liver and other vital organs. Symptoms of this type of poisoning include, beside the above irritations, headache, loss of appetite, nausea, and some mental confusion. These symptoms are often delayed and thus lull the victim into a false sense of security. The use of alcohol increases the susceptibility of individuals to this type of poisoning.

Carbon Tetrachloride — This is probably the widest used of the entire group and the best known. In spite of the fact that experiments and actual cases show the injurious effect of this substance on the liver, heart, kidneys and nervous system especially, industrial experience indicates that as actually used it is hardly any more harmful than many commonly used materials and may be the least harmful of all the chlorinated compounds. Acute poisoning from this source is rare and chronic poison cases are not numerous. It has been estimated that 1,000 p.p.m. is a safe limit for acute (rapid) poisoning and 100-300 p.p.m. for chronic (continued exposure) poisoning. Carbon tetrachloride can just about be smelled at 100 p.p.m. and is very strong at about 500 p.p.m. The latter strength may show slight effects after half an hour. However, it should never be necessary to have such a high concentration in the room, regardless of the purpose for

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which it is being used, and, in fact, most plants do not exceed the safe limit of 100 p.p.m.

Chloroform—This is another very well known substance which has high solvent powers but which is hardly used for this purpose because of its marked anesthetic effects. At the same time it is even less poisonous than carbon tetrachloride as may be judged from Table IV.

TABLE IV

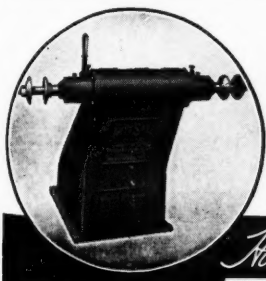
	p.p.m.
Deadly in 5-10 minutes	25,000
Dangerous in ½-1 hour	15,000
Tolerated for ½-1 hour	5,000

Effects of Chloroform

Di, Tri, and Tetra chlorethylene—Of these materials, trichlorethylene is the best known and its use in vapor and liquid degreasing is too common to require description. Dichlorethylene is hardly used in the metal industry and will not be further discussed, except to say that it is a weak narcotic and at least as poisonous as "tri." Tetra (or per) chlorethylene is being used to an increasing extent in the metal industry. It is to be hoped that this progress will continue because it is generally considered to be almost as little poisonous as carbon tetrachloride. It is non-inflammable like the rest, heavier than the "tri" and about as volatile as carbon tetrachloride. It is to some extent a narcotic.

Returning now to the subject of trichlorethylene, the substance is a heavy, low-boiling, colorless liquid with an odor like chloroform, insoluble in water. Although it is non-inflammable, at temperatures found in open flames, electric heaters and burning tobacco its vapors may decompose to form corrosive and poisonous substances like hydrochloric acid and phosgene. Good ventilation in such places, and absence of smoking, are therefore necessary. Strong light, continued heating above 257 deg. F. in air, and certain catalysts like aluminum dust also cause the formation of hydrocloric acid. To prevent such decomposition, it is common practice to add "stabilizers" to the "tri."

Trichlorethylene is definitely not harmless. Apparently its chief danger is in producing unconsciousness after prolonged exposure to concentrations over 10,000 p.p.m. (and



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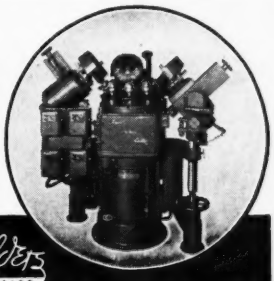

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death if exposure is then continued long enough) as in cleaning "tri" tanks, leaning over the tanks to examine the work, etc. About 200 p.p.m. has been set as safe maximum concentration. It is important to realize that 1 c.c. of liquid evaporates to 271 c.c. of vapor so that high concentrations in the air are possible. It has been recommended that rooms below about 20,000 cubic feet in volume be generally ventilated with about 30 air changes per hour, in addition to having lateral exhaust systems placed at the degreasing operation. Without the latter, concentrations near the degreasing tank have been reported 20 times as great as the average in the room itself. In large rooms (30,000-100,000 cubic feet) a general ventilation with 5-12 changes per hour has been satisfactory. Naturally, the operating conditions in any particular plant affect these generalized figures. In an investigation of about 40 factories, about one-fourth exceeded the safe limits.

Trichlorethylene exerts its damaging effect on the central nervous system, may cause some loss of vision, partial paralysis and skin disease, leads to a general lowering of vitality and in some cases to marked addiction. Its marked narcotic action (causing unconsciousness) has been mentioned. It is claimed by some that the poisoning action is not cumulative. With properly designed equipment, correctly placed and correctly ventilated, and operated bearing the above dangers in mind, there should exist a negligible industrial hazard from this material.

Tetrachlorethane — This solvent, which so far appears to be the most poisonous of all chlorinated hydrocarbons (maximum safe limit: 10 p.p.m.) should not be confused with the compound described above, tetrachlorethylene, practically the least poisonous. Tetrachlorethane is an excellent solvent for fats and gums and is one of the best solvents for cellulose acetate, having come into great prominence during the past war for this reason. It is a colorless liquid with a chloroform odor, noninflammable, not very volatile, active on aluminum and decomposing in the presence of moisture. Its main action, besides as a narcotic, appears to be as a powerful liver poison. During the war many cases of jaundice and appreciable deaths were ascribed to its use. Because of this danger, its use in lacquers and similar fields has rapidly dwindled.

Ethylene dichloride—This material is used as a solvent for fats, in lacquers and in dry cleaning. It is a powerful narcotic and years ago was used as an anesthetic. While severe cases of poisoning due to exposure to

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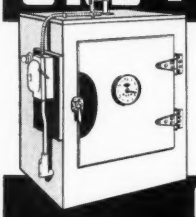

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high concentrations are known, no chronic symptoms from low concentrations have been reported and its distinctive odor usually gives warning of its presence in dangerous amounts. At the same time, the safe maximum concentration for it is thought by some to be 100 p.p.m. It is sometimes mixed with trichlorethylene and such a combination is apparently more dangerous than either substance alone.

Chlorbenzenes — In the above it was pointed out that the addition of chlorine to the fatty compounds increased their toxicity. The addition of chlorine to the aromatic hydrocarbons such as benzene has not this effect. In fact, monochlorbenzol may be less poisonous than benzol itself. This compound is used in lacquers and as a constituent in cleaning agents especially for household use. For metal cleaning, ortho dichlorbenzene is used, which is generally considered harmless. Para dichlorbenzene (moth preventative) also is common and is more toxic than the ortho compound.

Ideal Electric Markers and Electric Etchers are the subject of a four-page folder released by the Ideal Commutator Dresser Co., 1031 Park Ave., Sycamore, Ill. The Ideal Electric Marker can be used to mark glass, steel, iron, bronze, brass, hard rubber, bakelite, aluminum, alloys, wood, porcelain, and so on, while the Ideal Electric Etcher, available in "Standard," "Universal," and "Heavy Duty" types all of which are featured in the folder, is said to permanently engrave products made of iron, steel or their alloys, such as dies, gages, drills, gears, saws, shafting, and so on. Copy of folder free.

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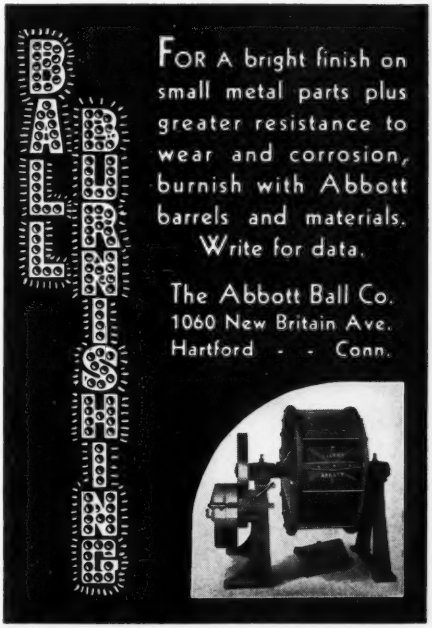
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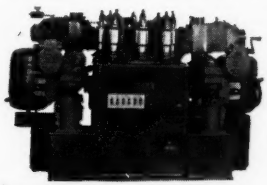

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News OF THE INDUSTRY

Promotions in Pennsalt Company

At the annual organization meeting of the board of directors of the Pennsylvania Salt Manufacturing Company recently held in the company's offices in the Widener Bldg., Philadelphia, Pa., the following officers were re-elected: Leonard T. Beale, president; Y. F. Hardcastle, vice-president; N. Emory Bartlett, vice-president.

L. A. Smith, well known in chemical and financial circles who came with the company in 1896 and advanced through minor positions to the office of secretary and treasurer, which he has held since 1921, was elected vice-president and treasurer. Warner R. Over, formerly assistant secretary and assistant treasurer, was elected secretary and assistant treasurer.

The Pennsylvania Salt Manufacturing Company, founded in 1850, is one of the oldest manufacturers of chemicals in the country and is one of the largest producers of chlorine and caustic soda. Beginning with the manufacture of heavy chemicals from salt, this company has expanded its field until today its products are used in many industries. Well known in the iron and steel field are its acid-proof cements and metal cleaners as well as its anhydrous ferric chloride, sal ammoniac, and mineral acids.

New Chicago Office and Warehouse for Detroit Rex

The Detroit Rex Products Company, manufacturers of degreasing machines, solvents, industrial alkali compounds, has moved its Chicago office to larger quarters at 1166 West Cermak Road.

Mr. S. Crooks, regional manager, states that in connection with these new modern offices there will be an equipment display room and complete warehouse facilities where stocks of degreasing solvents and alkalies will be maintained for quick delivery in the Chicago region.

In addition to field sales and service engineers working out of this office, a permanent resident design engineer is employed. The midwestern states are all served from the Chicago office as a control center with branches in Milwaukee and St. Louis. Stocks of solvent are also carried in these branch offices for prompt out-state delivery.

Continental Roll and Steel Foundry Polishing and Buffing Division Purchased by Hammond Machinery Builders

Hammond Machinery Builders, Inc., 1622 Douglas Ave., Kalamazoo, Mich., announces the purchase of the Automatic Polishing and Buffing Machinery Division of the Continental Roll and Steel Foundry Company, East Chicago, Ind., and its removal to Kalamazoo.

The Continental Automatic line complements the Hammond line of larger Rotary and Strait line automatic polishers and buffers, as well as Hammond's complete line of all types of polishing and buffing lathes and grinders.

Continental introduced a Loose Abrasive Method which is particularly valuable in the finishing of stainless steel, steel stampings and drawings, as well as odd shapes and contours.

Michigan Alkali Company Celebrates Fiftieth Anniversary

Michigan Alkali Company, Wyandotte, Mich., one of the nation's leading chemical industries, celebrated its golden jubilee recently with a banquet in honor of 567 veteran employees.

As a token of appreciation for their long service with the company, the honor guests were presented with gold

Mr. C. B. Robinson, president, and Mr. W. F. Torrey, secretary and treasurer of the J. B. Ford Sales Company, look on as Mr. E. L. Ford, president of the Michigan Alkali Company, cuts the huge birthday cake symbolizing the famous chemical company's golden jubilee celebration at Wyandotte, Michigan.

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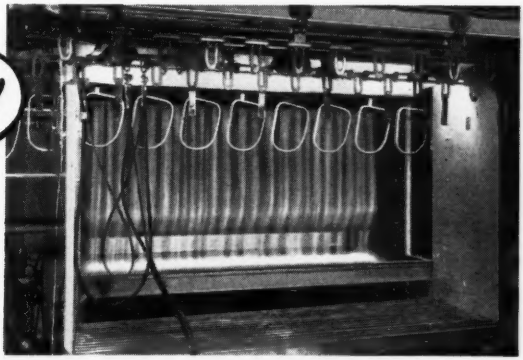

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watches. Awards were made by company officials, including Emory L. Ford, president, and J. B. Ford, Jr., vice-president. The banquet also was attended by J. B. Ford, Sr., retired president and grandson of the late Capt. J. B. Ford, founder of the company 50 years ago.

Joe Barron Heads AES Convention Program

Plans for the 29th Annual National Convention of the American Electroplaters' Society are now being formulated under the able leadership of Mr. Joe Barron, program chairman. The Hotel Statler, Boston, Mass., has been chosen for the scene of the convention which in 1941 will be held during the week of June 9th.

Those in charge of the various committees who will participate are as follows: Fin. Secretary, Andrew W. Garrett, 100 King St., Dorchester, Mass.; Educational, Arthur W. Collins, 220 Jamaicaway, Jamaica Plain, Mass.; Exhibits, Arthur J. Mintie, 50 Channing St., Wollaston, Mass.; Program, William Jones, 8 Saco St., Dorchester, Mass.; Registration, Charles O. Hardy, 98 Trenton St., East Boston, Mass.; Plant Visitation, Louis A. Gale, 15 W. 1st St., So. Boston, Mass.; Hotel Reservations, Edward C. DeLorme, 144 Winthrop Ave., Wollaston, Mass.; Advisory, Frank J. Clark, 151 Sumner Ave., Springfield, Mass.; Transportation, George H. Loeser, 46 Wesmur Rd., Malden, Mass.; Recreation, Walter L. Larsson, 330 Greenwood Ave., Greenwood, R. I.; Publicity, Louis V. Gagnon, 226 A Beacon St., Somerville, Mass.; Banquet and Entertainment, Louis Tosi, 80 State St., Cambridge, Massachusetts.

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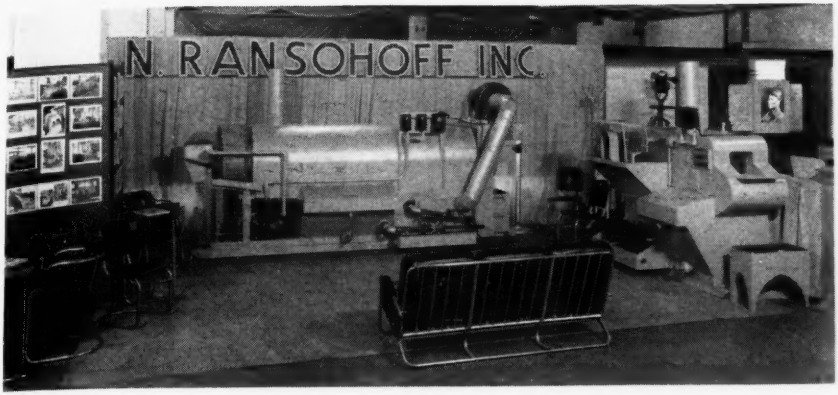
N. Ransohoff, Inc. at the National Metal Show

The accompanying photograph shows a glimpse of the booth of N. Ransohoff, Inc., 212 W. 71st St., Cincinnati, Ohio, which was exhibited at the National Metal Congress and Exposition, Cleveland, Ohio. At this exposition, a conveyor type washing machine and one-drum type washing and drying machine were in operation. The machines are used for inter-process cleaning as well as preparing work for plating and finishing. The machines are designed to remove oil and chips from the work and eliminate the still tank cleaning method.

Those in attendance at the booth



Ransohoff Booth at the National Metal Show

were as follows: N. Ransohoff, president; R. C. Wigger, manager; W. H. Young, testing engineer; H. E. Epley, W. Gerlinger, J. P. Bethke, C. E. Holmes, W. C. Irwin, P. B. Belches, L. L. Cannon, F. T. Mann, W. R. Niesslein, A. J. Welch, L. H. Wells, and G. E. Zorini.

Cowles Exhibit at National Metal Show

Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio, manufacturer of metal cleaners for the metal-finishing field, exhibited the display shown in the accompanying illustration at the National Metal Congress and Exposition held recently in Cleveland, Ohio. This special display acquainted the users of metals with the efficiency of Cowles cleaners when "cleaner surfaces for better finishes" are desired.

Those who were in attendance at the booth during the convention were: A. L. Mercer, president; H. L. Krembicki, manager, metal cleaner dept.; R. C. Burton, assistant manager, metal cleaner dept.; G. P. Needham and Clyde E. Lowe, salesmen.

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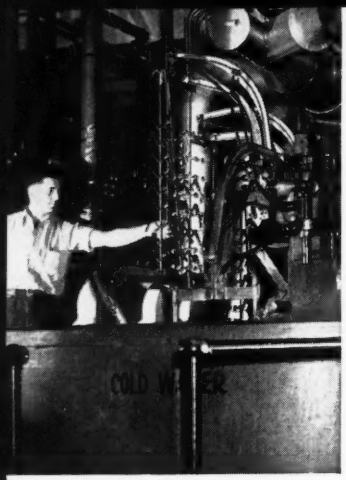
Cowles Detergent Booth at the National Metal Show



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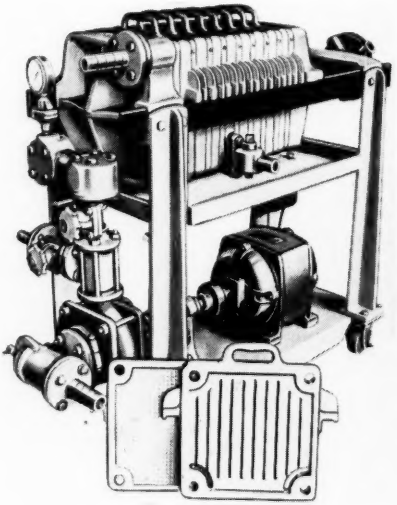
Shriver Filter Press

A new filter press, developed for the purpose of reducing the amount of time and labor required to remove the filter cake after filtration has ceased, has been placed on the market by T. Shriver & Company, 850 Hamilton St., Harrison, N. J. Manual cleaning of the filter press is ordinarily resorted to and as this work takes up a large share of the filtration cycle, considerable saving in time is said to be effected by this new method of cleaning out the filter press.

In general, this quick cleaning or sluicing filter is not unlike the usual type of plate and frame pressure filter. However, special frames have been designed with ribs which support the filter cloth so that pressure can be applied behind them. The operation of the sluicing filter for filtration is in the usual manner. When the filter chambers are full of solids, filtration is stopped and the remaining liquid drained off. Water from 30 to 50 lbs. pressure is then introduced and the drain cocks in the frames opened. This causes a sudden flow of water backwards through the filter cloth which loosens the cake and washes it out as a thin slurry through the drain cocks.

Short surges of sluicing water filling each chamber and then released by opening each cock in turn effect a quick removal of the cake. When sluicing is completed, the next filtration cycle may be started at once. Thus a long series of runs can be made without opening the filter for cleaning. The time required for sluicing the filter is much shorter than that required to open and manually clean a filter of the same size. Since sluicing involves only the manipulation of a few valves, one man can clean the largest filter with ease. It has been found by test that the filtrate yield using the sluicing method is as much as 30 per cent greater than that from filtration involving manual cleaning; the total time required for a series of sluicings is materially less than for opening and manually cleaning



Shriver Filter Press

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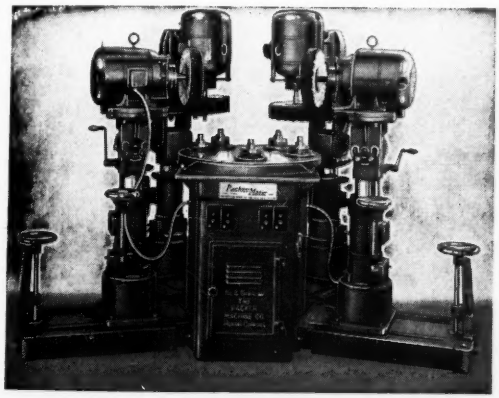
EXAMPLE: Plumbing Goods Mfgrs. find PACKER - MATIC the solution to the Finishing problem — More Production and Cutting Costs.



● PACKER-MATIC Polishes and Buffs parts of various sizes and shapes with equal efficiency and *Automatically.* PACKER - MATIC is made in Rotary, Straight Line Conveyor and Roll types. The Rotary type, No. 4, shown.

INTERESTED? Send sample Part or Blueprint for a Factory Proven "Time Study" and learn how you can Increase Production and Cut Costs on your Finishing. No obligation—WRITE to "Time Study" Department.

Pioneer Builders of Automatic Polishing and Buffing Machines

THE PACKER MACHINE CO. MERIDEN, CONN., U. S. A.

a filter press; and as the filter cake is in the form of a slurry when removed from the filter press, it can readily be disposed of without manual labor.

The unit illustrated herewith is a 12-in. closed delivery type press, having eight chambers and equipped with a large outlet cock for sluicing purposes. On larger filtering units individual outlet cocks are installed on each frame. These can be manipulated to concentrate the sluicing water in any one chamber so as to assure more complete discharge of the slurry.

Read about the many NEW DESPATCH FEATURES that improve finishes and permit new savings. They are presented for the industry in the new DESPATCH BULLETIN NO. 51

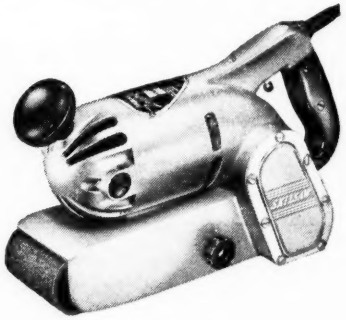
DESPATCH OVEN COMPANY

MINNEAPOLIS MINNESOTA

Skilsaw Belt Sander

A lightweight, 2¼-in. belt sander to be known as the "Zephyrplane Junior" has recently been introduced by Skilsaw, Inc., 4743 Winnemac Ave., Chicago, Ill. The "Zephyrplane Junior" is small and compact.

Among the features of the new Skilsaw unit are a die-cast aluminum frame for lightness and strength, ball bearing construction, and a powerful universal motor. Other features of safety and convenience are a bakelite handle for cool comfort, a safe trigger-type momentary switch, and a patented "touch control" lever which permits quick changing of belts.



Skilsaw Belt Sander

The belt travels at a speed of 600 sur. ft. per min., is kept uniformly taut by a coil spring and is easily centered by a simple adjustment. A variety of belts are available adapting the tool for use on metal, for removing finishing materials, and for polishing.

The Zephyrplane Junior has been de-

"Glazing Shoulders" Before Mirror Finishing with 4F Turkish Emery

The W. R. Case & Sons Cutlery Company, Bradford, Pa., uses "Indian Brand" 4F Turkish Emery to glaze shoulders of knives before mirror finishing.

"Indian Brand" Turkish and Naxos Emery and "Hecco Brand" American Emery are absolutely uniform and of the highest quality . . . they have greater capillarity and longer wear . . . they will be delivered promptly.

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signed in such a way that uniform pressure is applied over the entire sanding area. The weight of the Zephyrplane Junior is 9½ pounds.

Cowles MC Metal Cleaner

The Metal Cleaner Department of the Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio, has announced the addition of Cowles MC Cleaner to its line. MC Cleaner is a medium pH material of unique anionic balance, containing an effective detergent accelerator. Cowles MC Cleaner is suitable for still tank work and highly recommended for cathodic cleaning of steel, brass, and copper. MC Cleaner is readily soluble, cleans fast, and rinses rapidly. It is economical to use because it is technically anhydrous in composition, thus chemically clean metal can be obtained by using low concentrations.

Stanley Aluminum Finish

An aluminum-synthetic finish which is said to have exceptional color, brilliance, adhesion, and durability has been placed on the market by The Stanley Chemical Company, East Berlin, Conn. This material is available in baking or air drying forms. These two forms have been designated as No. 66H-1307 Aluminum Baking Synthetic and No. 66H-1515 Aluminum Air Drying Synthetic.

Both of the aluminum finishes produce coatings which are said to closely resemble dull-chrome plated finishes. They are extremely durable, have excellent adhesion and weather resisting qualities, and are said to be so smooth that they produce an appearance of a continuous sheet of aluminum. On long standing, they are said to retain to a very high degree their color and leafing qualities. They are non-settling and only normal stirring is required before use.

While both materials are intended for spray application, No. 66H-1307 Aluminum Baking Synthetic has unusual flow and dipping qualities which are said to leave the surface free from sags, runs, or drips. This coating is recommended for baking at 325 deg. F. for 45 minutes.

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RUST INHIBITIVE

Formulated specifically for the following properties:

1. Very fast air-drying
2. Water-whiteness
3. Tenacious adhesion
4. Hardness combined with flexibility

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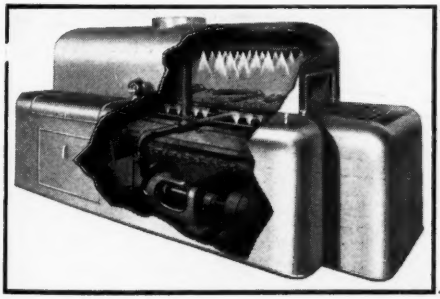
RUST RESISTANCE

S-310

is used and recommended as a clear coating for hand tools, machine tools, hardware and wherever a clear protective coat for bright metal is required.

The Varnish Products Co.
5208 Harvard Ave. Cleveland, Ohio



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International Conveyor & Washer Corp.
640 E. FORT ST. DETROIT, MICH.

Hygrade Miralume F-230

To meet the demand for a more powerful light source for industrial applications where high total lumens are required for each lighting fixture, Hygrade Sylvania Corp., Salem, Mass., has developed the Miralume F-230, a complete fluorescent lighting unit designed to incorporate 100-Watt Hygrade Fluorescent Lamps. The unit is supplied complete with two 100-watt white fluorescent lamps, each 5 ft. long, and is furnished completely wired and ready for use. The Miralume is corrected for stroboscopic effect and is available with Hygrade's Dua-Lamp Auxiliary. In addition, the unit features corrected power factor and uses the Hygrade Mirastat — an improved starter designed particularly for the 100-watt lamp.

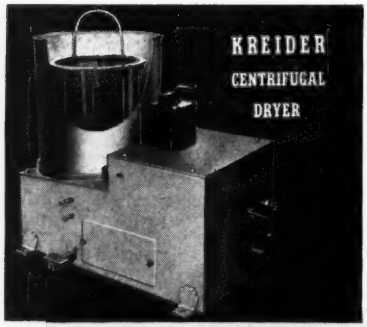
Hygrade Miralume F-230

The Hygrade Miralume F-230 is finished outside in French Gray and has a reflecting surface of porcelain enamel, thereby making it easy to clean. The unit has a total wattage (including lamps and auxiliary) of 230 watts and is available for 110-125 volts, 60 cycle a.c. Lead wires are supplied as standard equipment, and cord and cap can be furnished on order.

Divine Automatic Composition Applicator

A composition applicator which automatically and mechanically applies buffing compound to the face of buffing wheels in an exact controlled amount and frequency is now being marketed by Divine Brothers Company, Utica, N. Y. This applicator can be used in conjunction with lathes for hand buffing and is particularly adaptable to all types of automatic and semi-automatic buffing machines.

The Divine Automatic Composition Applicator is a self-contained unit and requires only simple wiring to an electric current source, thus it can be easily removed from one machine to another. The unit can be mounted in any position which might ordinarily be required from horizontal to vertical. Open construction of the applicator per-



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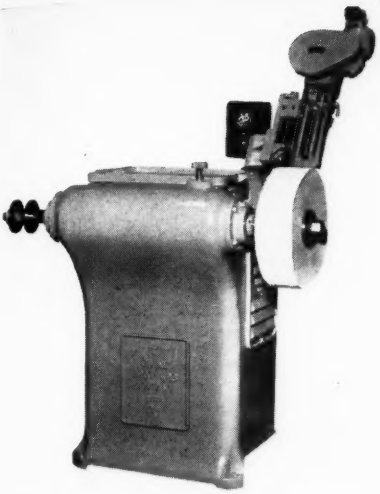

Divine Automatic Composition Applicator

mits dissipation of heat which might possibly melt the composition bars and the stroke is arranged to keep the bar out of the heat zone around the face of the wheel.

The action of the applicator is smooth, approximating proper manual application. It is said to operate without vibration, and there is no ramming impact of the composition bar against the wheel face which might tend to overload the wheel or break the bar.

Adjustments of the unit are provided to control the amount of composition applied at each stroke and the number of strokes per minute. As the buffing wheel wears down in diameter, a simple, quick adjustment keeps the applicator in proper contact with the wheel face. When the bar of compound is worn down to a very small stub, new bars can be quickly installed.

The motor of the applicator is protected by means of thermal elements in the switch. Should the applicator exhaust the supply of composition unnoticed, no harm can result, since the applicator simply operates in an idling position.

A wide applicator for wide composition is available for wide faced wheels. The Divine Automatic Composition Applicator can be used to automatically apply grease stick to polishing wheels. The operation is said to be the same as for applying composition to buffing wheels.

Murray-Way Automatic Buffing and Polishing Equipment

A new line of automatic buffing and polishing equipment, developed to fill the need for buffing heads which can be quickly adjusted to any wheel posi-

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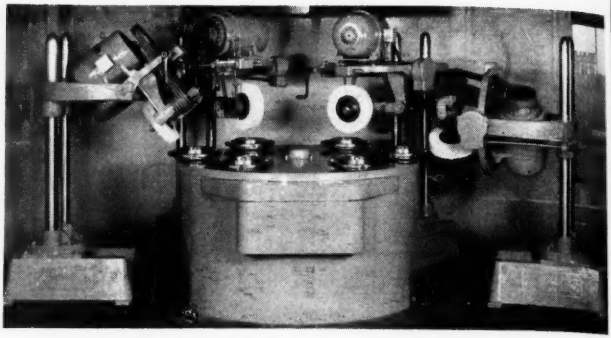
Murray - Way Automatic Buffing and Polishing Equipment



tion for successive and production finishing, has been placed on the market by Murray-Way Corporation, 253 Vinewood, Detroit, Michigan.

Murray - Way Automatic Buffing and Polishing Equipment may be used in combination with dial type, indexing or continuous rotation machines, or continuous straight-line conveyors. The entire drive is mounted on a turntable which has a full 360 deg. of movement. The turntable and ring assembly, as a unit, is swiveled in the yoke member having, in the opposite plane, a full 360 deg. adjustment. Therefore, the wheel may be moved to any position, as there are no blind spots.

Besides the rotating of these two members, the entire head assembly may be moved up and down on the two columns which, in turn, have a swivel and lateral adjustment in the base. According to the manufacturer, all of these adjustments may be made quickly and easily. Crank handles are furnished for all adjustments.

According to the manufacturer, the buffing spindle is full floating with adequate means provided for taking up wheel wear and maintaining a predetermined work pressure. The dial table has a constant index time but the time of dwell is varied over a wide range by means of electric controls. The timing device is graduated in seconds and minutes. All indexing mechanism and fixture drives are completely enclosed and operated in a bath of oil.

Murray-Way Automatic Buffing and Polishing Equipment is designed for universal application and, it is said, will not become outmoded by a change in product design.

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TRADE MARK
First quality aluminum oxide abrasive grain manufactured in our own electric furnace plant under strictest standards of quality and uniformity. Available in four types (CT, T, B, TB), each of which is most efficient for polishing work within its field of application. Write for Abrasive Grain Data Sheet No. 1 giving complete details. Samples sent of grain sizes you specify.
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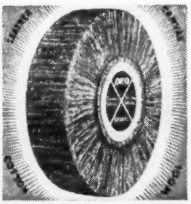
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MANUFACTURERS OF
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SPECIALTIES

Metso 88 Special

A special alkaline silicate cleaner for aluminum, tin, and alloys of either has been announced by the Philadelphia Quartz Company, Philadelphia, as the newest member of their line of Metso Cleaners.

It is reported that the ingredients of the new cleaner, called "Metso 88 Special," permit effective use in either hot or cold, hard or softened water. The cleaner is a free rinser. It goes into solution immediately and is completely soluble, thus eliminating the danger of cleaning material settling to the bottom of the tank.

The cleaner quickly removes animal, vegetable, or mineral oils, as well as solid dirt, from sensitive metal surfaces and at the same time provides a greater margin of safety than is available from the alkaline cleaners customarily in use. Consequently its special application for cleaning aluminum, tin, and other soft metals, makes this cleaner of particular interest to the food and packing industry. Metal working and finishing plants which process aluminum or tin parts also require a cleaner that provides necessary protection against etching or spangling.

Another unique feature is that the cleaner is packed in concentrated liquid form and merely requires dilution before use. The cleaner is also used in washing machines for various purposes, and is entirely safe for cleaning by hand.

Midco P-5 Pickling Inhibitor

A pickling inhibitor which is said to reduce pitting, save metal, and permit rapid scale removal, to be known as Midco P-5, has been placed on the market by Midcontinent Chemicals Corporation, 6805 N. Clark St., Chicago, Illinois.

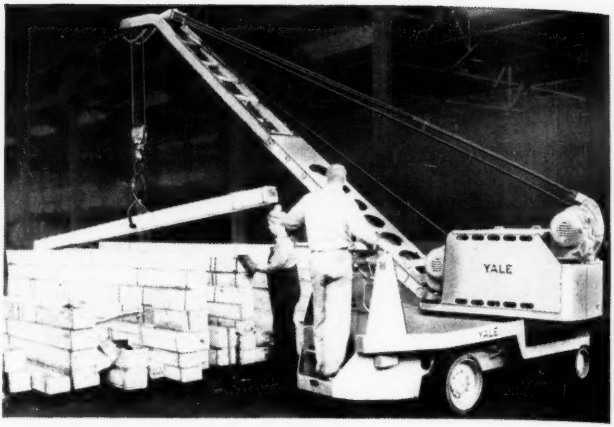
Midco P-5 Pickling Inhibitor can be used on steel, copper, brass, stainless steel, aluminum, castings, forgings, stampings, and alloys.

Midco P-5 can be used in hyrochloric acid, sulfuric acid, mixed acids, butyric acid, acetic acid, hydrofloric acid, stainless steel pickle, pickling acids, and formic acid.

Yale & Towne Utility Service Truck

The illustration shows a Yale & Towne Utility Service Truck made by The Yale & Towne Mfg. Co., 4532 Tacony St., Philadelphia, Pa., in operation at the plant of a large western metals and supply company. The truck is powered by giant electric batteries, is mounted on a base equipped with rubber-tired wheels, and has a 78-in. wheelbase which allows an extremely short turning radius. The boom has a reach of 17 ft., can be swung in an arc of approximately 300 deg., and has lift-

Yale & Towne Utility Service Truck at Work



ing capacity of 6,000 lb. at a 7-ft. outreach.

In the plant in which this truck is used it has proved valuable in more ways than one. Whereas by the old method of loading pipe and other stock into trucks there was a high percentage of accidents such as crushed hands, wrenched backs, and foot injuries, the use of this truck has reduced the accident percentage to the absolute minimum.

Undoubtedly the chief factor in the efficiency of the unit is its mobility. In the pipe yard stacking the larger sizes of pipe, transporting pipe to the threading machines, or loading shipments on the trucks, this service truck is a most useful piece of equipment.

Hanson-Van Winkle-Munning Aluminum Oxide Polishing Grain

A fused aluminum oxide produced in an electric furnace is now being marketed by the Hanson-Van Winkle-Munning Company, Matawan, N. J., under the trade name of Vanite. Vanite is a polishing grain composed of bauxite from which impurities such as titanium oxide, iron oxide, silica, and so on, have been removed.

The Vanite grains are of the "blocky" type and as nearly equi-dimensional as possible and practically free from weak particles like flats and slivers. Grain size is closely controlled by screening and separation into oversize, nominal, and undersize. The nominal is the control product. Oversize is coarse and undersize is fine. Each keg of Vanite is subjected to a careful screen analysis to determine the percentages of the three sizes.

Capillarity or "degree of wetting" is one of the important qualities for which Vanite is known. One of the outstanding advantages of Vanite is the consistent uniformity of the polishing grain with respect to size, shape, and chemical composition. The grains of

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Vanite are said to maintain consistent uniform angularity, solidity, strength of grain, sharpness, and high cutting action. Vanite can be used with animal hide glue or abrasive cement.

Available sizes of Vanite Polishing Grain listed from coarse to fine are as follows: 4 - 6 - 8 - 10 - 12 - 14 - 16 - 20 - 24 - 30 - 36 - 46 - 54 - 60 - 70 - 80 - 90 - 100 - 120 - 150 - 180 - 220 - 240 - F - FF - FFF.

Pynosol NuSteel

A cleaning material to be known as "NuSteel" for removing heat tint, cleaning, polishing, and finishing stainless steel and Monel has been placed on the market by Pynosol Laboratories, Inc., 215 N. Aberdeen St., Chicago, Ill. NuSteel cleaners can be used in conjunction with power application; that is, with special tampico wheel brushes and slow speed portable polishing machines.

By means of power application, NuSteel is said to remove stubborn heat tint of a low chrome oxide, also those from arc, spot, shot, and acetylene welding. The removal of these tints is said to be accomplished without disturbing the original polished finish.

NuSteel cleaner will thoroughly clean stainless steel and Monel and produce a lustre that is said to add "eye appeal" to the completed fabricated part.

Two types of NuSteel cleaners are adaptable to power application, namely, NuSteel Paste and NuSteel Liquid No. 9, Type 5060. Both products are said to be identical in composition, one being a paste and the other in liquid form so that it may be applied manually or with a spray gun.

Rock-Tred Floor Resurfacer

A pre-mixed floor resurfacer made of special gum-like material that is said to cure to concrete-like hardness and to provide wear surface throughout its entire thickness, to be known as "Rock-Tred," has been placed on the market by the Rock-Tred Co., Inc., 629 Washington Blvd., Chicago, Ill. According to the manufacturer, Rock-Tred can be placed indoors or outdoors from ½ in. in thickness to a feather edge and bonds permanently to concrete, metal, rigid wood flooring, or asphalt mastic floor. It can be used in from 8 to 12 hours after it is installed and is said to get harder under severe usage.

Rock-Tred has no load limit. It is claimed to sustain any load that the subfloor, driveway, trucking aisle, or platform can hold. In addition, the material is said to be dustless, noiseless, and sparkless. It is also claimed to resist heat, fire, and acid and is a nonconductor of electricity. Rock-Tred is delivered ready to apply and can be put down by anyone.

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BARON STEUBEN
HOTEL

DeWITT OPERATED HOTELS

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R. F. Marsh, Vice Pres. and Gen.-Mgr.

Pyroflex

A new inorganic finish to be known as "Pyroflex," which is said to further reduce burning temperatures of porcelain enamel, has been placed on the market by The Porcelain Enamel & Manufacturing Co., Eastern and Pemco Aves., Baltimore, Md. "Pyroflex" is said to burn at 1,400 deg., thus permitting the use of light gauge enameling stock or black iron.

Pyroflex, as the name indicates, will withstand heat and, according to the manufacturer, will not flake off when bent or flexed. No special metal bonding treatment is necessary. Pyroflex is available in a wide range of colors, effects, and graining finishes.

Jefferson Endless Belt Sander

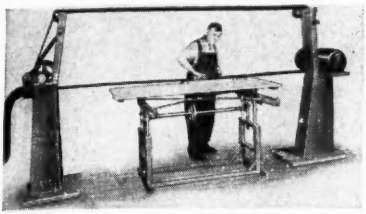
Designed to eliminate hand sanding and finishing, the Jefferson Endless Belt Sander shown in the illustration has been placed on the market by the Jefferson Machine Tool Co., Fourth, Cutter and Sweeney Sts., Cincinnati, Ohio. The sander is made for use with wood or metal and can be used on large flat surfaces as well as concave, convex or any irregular work.

The flexible belt responds quickly to the operator's touch. The table travels on ball-bearing rollers and is easily moved to carry the work back and forth while the operator applies pressure to the flexible belt with a block or pad. The belt travels at the proper level to enable the operator to work in a natural position without straining. The overhead idlers run on high grade ball bearings. Both idlers are adjustable for aligning sand or emery belt, and one idler has an adjustable counterbalancing spring to regulate tension of belt. The vertical adjustment of the table provides for work of exceptional thickness.

The belt standards are independent and are built of heavy structural steel, electrically welded together. They are self-supporting and can be placed at any distance apart to accommodate any length of work. An auxiliary bed is placed on the regular table for handling exceptionally long work.

The table frame is built of heavy 2-in. angle steel, electrically welded together to form a rigid and substantial base for the table. The work table has a vertical adjustment by handwheel of

10 in. The table stands 32 in. from the floor and is adjustable up to 42 in. The table top is 30 in. wide x 72 in. long and is built of wood.



Jefferson Endless Belt Sander

The main sand belt pulleys are 12-in. diameter x 8-in. face and will accommodate belts up to 8 in. wide. Bearings of the sander are of the heavy duty dust proof type, equipped with Alemite fittings. The sander is furnished with direct drive from a 2 h.p. motor 220 or 440 volts, a.c., 2 or 3 phase, 60 cycles. For wood finishing, the belt travels at approximately 5,000 s.f.m. For metal finishing, the belt travels at approximately 18,000 s.f.m., which is the standard speed used in most metal working shops.

Hygrade 100-Watt Fluorescent Lamp

The need for a large size fluorescent lamp which would extend the advantages of fluorescent lighting for general illumination to large areas has led to the development of the Hygrade 100-Watt Fluorescent Lamp which is now being marketed by Hygrade Sylvania Corp., Salem, Mass. The lamp is 60 in. long, 2⅛ in. in diameter, and is available in White. It will soon be available in Daylight also.

The base of the Hygrade 100-Watt Fluorescent Lamp is Mogul Bi-Pin (similar to present Hygrade lamp bases but larger) and the rated average life is 2,000 hours. The lamp has an initial lumen output of 44 lumens per watt and is said to produce an average of 880 lumens per foot.

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Crawford baking oven, insulated panel construction, double door in front and rear with steel insulated floor. Clear inside dimensions—10′ 9″ wide, 9′ 3″ high, 18′ 0″ deep. Heated with Ross-Nichols two section indirect oil fired heater. Temperature controlled by Foxboro heat recording instruments. Temperature up to 400 degrees. Excellent condition.

J. O. Ross Engineering Corp. steam heated baking oven, insulated panel construction. Clear inside dimensions—11′ 6″ wide, 7′ 0″ high, 6′ 0″ deep, two doors in front extending along the 11′ 6″ wide dimension. Complete.

HUBENY BROTHERS, Inc., Roselle, N. J.

This Opportunity Section is available for classified advertisements featuring equipment, employment, business opportunities, etc., in the industries devoted to the cleaning, plating, polishing and finishing of metals. For advertising rates and other information address:

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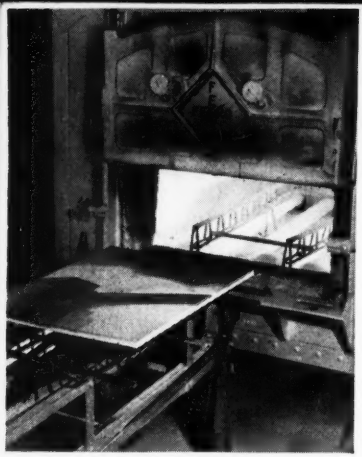

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To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. General Electric Reactrol System

Eight ways in which the Reactrol system gives exact temperature control are described in a bulletin now being issued by the General Electric Company, Schenectady, New York.

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2. Elastic Primer

A rust preventative known as Elastic Primer is described in a four-page folder now being issued by American Chemical Paint Company, Dept. 303, Ambler, Pennsylvania.

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3. Hayes Lite-Master

Information on streamlined fluorescent lighting equipment for both commercial and industrial uses is contained in a bulletin now being issued by Hayes Manufacturing Corporation, Grand Rapids, Michigan.

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4. Globe Finishing and Tumbling Barrels

One of the most completely illustrated catalogs on finishing and tumbling barrels for metal parts is now being issued by The Globe Machine & Stamping Company, 1250 W. 76th St., Cleveland, Ohio.

5. Orvus for Alkaline Cleaning Baths

All those engaged in metal cleaning operations will be interested in information regarding an alkaline cleaning bath addition agent known as Orvus now being distributed by Procter & Gamble Co., Gwynne Bldg., Cincinnati, Ohio.

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6. Heatbath Metal Treating Chemicals

A beautifully illustrated catalog describing Pentrate finishes for steel products is now being issued by Heatbath Corporation, Springfield, Massachusetts.

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7. Despatch Finish Baking and Drying Ovens

A very complete 12-page catalog covering Despatch Finish Baking and Drying Ovens for synthetic enamels, lacquers, varnishes, paints, enamels, and japans is now being issued by Despatch Oven Company, 622 S. E. Ninth St., Minneapolis, Minnesota.

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8. Rust Prevention for Iron and Steel

A description of Parkerizing, what it does, and how it is applied is contained in a book entitled "Parkerizing" now being issued by Parker Rust Proof Company, 2172 E. Milwaukee Ave., Detroit, Michigan.

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9. Griptite Metal Cement

Literature describing a rubber cement for bonding rubber, felt, cardboard, and so on, to metal is now being distributed by St. Louis Rubber Cement Co., 3952 W. Pine Blvd., St. Louis, Missouri.

10. Airway Ventilated Buffs

Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 21-03 41st Ave., Long Island City, New York.

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11. Paper Masking Tape

A masking tape that is highly resistant to lacquers, paints, and solvents is described in this folder now being issued by Industrial Tape Corporation, New Brunswick, New Jersey.

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12. Dust Control

A complete story of dust control in words and pictures by means of Roto-Clone dust control equipment is now being issued by American Air Filter Company, Inc., 702 Central Ave., Louisville, Ky.

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13. Weka Grinding and Polishing Wheels

A six-page folder describing and illustrating Weka grinding and polishing wheels is now being issued by Atlantic Weka Corp., 35 Wooster St., New York City.

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14. Metal Cleaning Tips

The chemical classification and selection of alkaline metal cleaners is contained in a bulletin which has been prepared and is now being distributed by the Cowles Detergent Company, 10525 Carnegie Ave., Cleveland, Ohio.

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15. Industrial Ovens

An illustrated industrial oven book featuring safety, speed, economy, and efficiency in industrial drying and finishing processes is now being issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio.

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16. Salts of the Platinum Metals and Gold

A beautifully illustrated 12-page catalog containing complete tables of information on platinum metals and gold is now being issued by Baker & Co., Inc., 113 Astor St., Newark, New Jersey.

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17. Grinding Wheel Data Book

A 112-page catalog containing complete descriptive information about the manufacture, use and application of grinding wheels is now being issued by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pennsylvania.

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18. Analysis of Plating Solutions

The fifth edition of this booklet describing simple methods of analyzing plating solutions is now being issued by Hanson-Van Winkle - Munning Co., Matawan, New Jersey.

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